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SENATE

REPORT
98-455

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AUTHORIZATION ACT

MAY 17 (legislative day MAY 14), 1984 ~~1982.~~—Ordered to be printed

Mr. PACKWOOD, from the Committee on Commerce, Science, and Transportation, submitted the following

REPORT

[To accompany H.R. 5154]

The Committee on Commerce, Science, and Transportation, to which was referred the bill (H.R. 5154) to authorize appropriations to the National Aeronautics and Space Administration for research and development, space flight, control and data communications, construction of facilities, and research and program management, and for other purposes, having considered the same, reports favorably thereon with an amendment in the nature of a substitute and recommends that the bill do pass.

PURPOSE OF THE BILL

The purpose of this bill is to authorize appropriations to the National Aeronautics and Space Administration (NASA) totaling $7,582,400,000 for fiscal year 1985 as follows:

	Budget request	Committee authorization
Fiscal year 1985:		
Research and development	$2,400,100	$2,516,100
Space flight, control, and data communications	3,600,300	3,585,300
Construction of facilities	160,000	150,000
Research and program management	1,331,000	1,331,000

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COMMITTEE ADJUSTMENTS TO NASA REQUEST FOR FISCAL YEAR 1985—SUMMARY

Fiscal year 1985	Administration request	Committee authorization
Research and development:		
Space transportation systems	$361,400,000	$356,400,000
Space station	150,000,000	150,000,000
Physics and astronomy	677,200,000	705,200,000
Life sciences	63,300,000	63,300,000
Planetary exploration	286,900,000	296,900,000
Space applications	344,100,000	407,100,000
Technology utilization	9,500,000	9,500,000
Space commercialization		5,000,000
Aeronautical research and technology	342,400,000	357,400,000
Space research and technology	150,000,000	150,000,000
Space tracking and data systems	15,300,000	15,300,000
Total	2,400,100,000	2,516,100,000
Space Flight, Control and Data Communications:		
Space Shuttle production and operational capability	1,465,600,000	1,470,600,000
Space transportation operations	1,339,000,000	1,319,000,000
Space tracking and data acquisition	795,700,000	795,700,000
Total	3,600,300,000	3,585,300,000
Construction of facilities	160,000,000	150,000,000
Research and program management	1,331,000,000	1,331,000,000
Grand total	7,491,400,000	7,582,400,000

LEGISLATIVE HISTORY

On February 1, 1984, the fiscal year 1985 budget request for the National Aeronautics and Space Administration (NASA) was submitted to Congress. The Committee considered the budget request in hearings on February 28, March 1, 8, and 29. Testimony was received from the NASA Administrator and Deputy Administrator and from representatives of the Department of Defense, the aerospace industry, the space science and applications communities, and other outside witnesses. On May 1, 1984, Senator Gorton, along with Senators Packwood, Hollings, Heflin, and Lautenberg, introduced the National Aeronautics and Space Administration Authorization Act of 1985, S. 2612, which was referred to the Committee on Commerce, Science, and Transportation.

On May 8, 1984, the Committee considered S. 2612. Senator Gorton offered an amendment to S. 2612 that specified that the 1987 flight test of the advanced turoboprop aeronautical propeller design should test either the single rotation or the counter rotation design. The amendment passed without objection. Since the House NASA authorization (H.R. 5154) had already been referred to the Committee, the Committee offered S. 2612, as amended, as an amendment in the nature of a substitute to H.R. 5154. The Committee then ordered H.R. 5154 to be reported.

SUMMARY OF MAJOR PROVISIONS

For fiscal year 1985, the Committee's NASA authorization bill authorizes $7,582,400,000, of which $2,516,100,000 is for research and development; $3,585,300,000 is for space flight, control, and data communications; $150 million is for construction of facilities; and $1,331 million is for research and program management.

The space transportation systems (STS) budget of $356,400,000, compared to $431,700,000 in fiscal year 1984, provides for continued development of Spacelab hardware and for three Spacelab operational flights. Also included in fiscal year 1985 STS funding are development and operations activities for upper stages and for continued design and development of the hardware for the U.S./Italian tethered satellite system.

The Committee has provided the full $150 million requested by the administration for extended definition and design studies for a permanently manned space station to be operational within a decade.

The budget for the space sciences programs in fiscal year 1985 is $1,065,400,000, compared to $843 million in fiscal year 1984. This increase is comprised largely of additions to research and analysis programs in physics and astronomy and in planetary exploration and for Shuttle/Spacelab payload development activities in physics and astronomy. Planetary exploration funding provides for a new planetary mission, the Mars geoscience/climatology orbiter, and for continued planning and development of the planetary missions to Venus and Jupiter.

The space applications funding for fiscal year 1985 is $407,100,000, compared to a fiscal year 1984 operating level of $291 million. Within environmental observations, there are two new initiatives, the upper atmosphere research satellite and the Scatterometer sensor for the Navy remote ocean sensing system. Space applications funding also provides for an increase in microgravity research activities and for a flight test program to develop the advanced communications satellite technology (ACTS).

The Committee has authorized $5 million for a new initiative, space commercialization, as a means of encouraging government/industry partnerships in commercial space activities.

The Committee authorized $357,400,000 for aeronautical research and technology, compared to $302,300,000 in fiscal year 1984. The increase of $55,100,000 in Aeronautical Research and Technology is comprised of a $37,600,000 increase in systems technology and a $17,500,000 increase in research and technology base.

$150 million is authorized for space research and technology, a $13 million increase above the fiscal year 1984 level.

Tracking and data acquisition advanced systems for fiscal year 1985 is $15,300,000, up from the fiscal year 1984 level of $14,200,000.

The total research and development budget for the above-mentioned programs for fiscal year 1985 is $2,516,100,000 compared to the fiscal year 1984 funding level of $2,028,200,000.

Within the space flight, control, and data communications budget of $3,585,300,000, the Space Shuttle production and operational capability program is funded at a level of $1,470,600,000. This funding level enables NASA to complete the production of the fourth Space Shuttle orbiter, Atlantis, and to maintain the production readiness for a fifth orbiter, a position the Committee has supported in the past. Also included within Space Shuttle production and operational capability is funding for production of the main engines and critical orbiter spares.

Shuttle operations activities within space flight, control, and Data Communications are funded at a level of $1,319 million. This funding provides for the procurement of the external tanks, the solid rocket motors and boosters hardware, flight operations and launch and landing activities.

Finally, within space flight, control, and data communications, $795,700,000 is made available for space and ground networks, communications, and data systems activities at a level of $795,700,000, most of which finances the tracking and data relay satellite system (TDRSS).

The Committee recommendation for construction of facilities for fiscal year 1985 is $150 million, $5,500,000 less than the fiscal year 1984 level. The Committee recommendation for research and program management, is $1,331 million, compared to $1,258,500,000 in fiscal year 1984.

S. 2612 includes language prohibiting the use of the space station to carry or deploy nuclear weapons or any other weapons of mass destruction.

The bill also directs NASA to finalize and enter into, as expeditiously as possible, a contract to develop the advanced communications technology satellite (ACTS), which is authorized in this bill under research and development. Further, according to this provision, NASA is to enter into this contract only with the entity with which it had been negotiating prior to the passage of this bill.

Title II of the bill instructs the President to establish a National Commission on Space in order to make a comprehensive investigation of existing and proposed space activities in the United States and to make recommendations for a long-term space policy.

The Commission shall consist of 23 members appointed by the President, including 4 ex officio members and 4 advisory members. The four ex officio members will be Federal employees involved in space activities and the four advisory members will be from among the membership of the Congress—two each from the Senate and the House of Representatives.

The Commission would report its findings and recommendations to the President within 1 year following its establishment and would cease to exist within 60 days after the submission of its report.

One million dollars from within available funds would be authorized for the Commission's activities in fiscal year 1985.

RESEARCH AND DEVELOPMENT—$2,516,100,000

SPACE TRANSPORTATION CAPABILITY DEVELOPMENT—$356,400,000

The Committee has authorized $356,400,000 for fiscal year 1985 for space transportation capability development, $5 million less than the administration's request, as follows:

Summary of funding levels, fiscal year 1985

Spacelab	$69,300,000
Upper stages	92,400,000
Engineering and technical base	105,700,000

Payload operations and support equipment	56,300,000
Advanced programs	14,500,000
Tethered satellite system	18,200,000
Total	356,400,000

The principal areas of activity in space transportation capability development are efforts related to the Spacelab, the upper stages that place satellites in high altitude orbits, the engineering and technical base support at NASA centers, payload operations and support equipment, advanced programs study and evaluation efforts, and the development and first flight of the U.S./Italian tethered satellite system.

The Spacelab is a major element of the STS and provides a versatile, reusable laboratory which will be flown to and from Earth orbit in the Shuttle orbiter cargo bay. The program is being carried out jointly by NASA and the European Space Agency (ESA). NASA's support of the Spacelab development effort includes ancillary flight and ground hardware and system integration activation efforts which assure Spacelab compatibility with the experiments and orbiter, leading to an operational capability.

The upper stages project includes the effort necessary to provide upper stages for use with the Space Shuttle to place payloads in orbits and trajectories beyond the capability of the Shuttle alone, primarily for planetary and geosynchronous missions. Current developments include the two-stage inertial upper stage and the modification of the Centaur/STS for use with the Shuttle. In addition, a new upper stage, the transfer orbital stage, is being planned for use in launching the Mars geoscience/climatology orbiter (MGCO) in 1990.

The engineering and technical base provides the core capability for the engineering, scientific and technical support required at the Johnson Space Center (JSC), the Kennedy Space Center (KSC), the Marshall Space Flight Center (MSFC), the White Sands Test Facility (WSTF), and the National Space Technology Laboratories (NSTL) for space transportation systems research and development activities.

In fiscal year 1985 and subsequent years, computational capability is included to provide for complex flow dynamics modeling and other analyses in support of MSFC programs.

Payload operations and support equipment provides for developing and placing into operational status the ground and flight systems necessary to support the space transportation system payloads during prelaunch processing, on-orbit mission operations, and, when appropriate, post-landing processing.

The advanced programs effort identifies potential future space programs and provides technical as well as programmatic data for their definition and evaluation. In support of this effort, advanced development activities are conducted to provide a basis for obtaining significant performance and reliability improvements and reducing future program risks and development costs through the effective use of new technology.

The tethered satellite system (TSS) will provide a new capability for conducting space experiments in regions remote from the Shuttle orbiter. The objectives of the initial TSS mission scheduled for late 1987, are twofold: (1) to verify the controlled deployment, operation, and retrieval of the tethered satellite, and (2) to quantify the interaction between the satellite/tether and space plasma in the presence of a current drawn through the tether.

The initial Spacelab mission was launched on November 28, 1983, and was completely successful. During 1983 the prelaunch integration and checkout, launch and mission, and post launch deintegration were successfully accomplished. Evaluation of mission data has begun. Staging activities for Spacelab-2 (SL-2), Spacelab-3 (SL-3), OSTA-3, and SL-D1 were started this year.

In upper stages, a joint development program between NASA and DOD, was initiated in fiscal year 1983 for the use of the Centaur as an STS upper stage. The common vehicle, designated Centaur-G, accommodates a 40-foot long, approximately 10,000-pound payload in the orbiter vehicle bay and is capable of placing it into geosynchronous orbit. A longer version if the Centaur-G, known as G′, is being developed by NASA for launch of the Galileo and International Solar Polar Mission (ISPM) spacecraft in mid-1986. Procurement will be initiated in fiscal year 1985 for two G vehicles to support the Venus radar mapper mission (VRM) in 1988 and the TDRS-E mission.

The inertial upper stage (IUS) is undergoing tests and evaluation following a failure of the IUS on STS-6 in April, 1983, during a maneuver to deploy the tracking and data relay satellite (TDRS)-A. After the TDRS had been successfully deployed from the Shuttle, a failure occurred while the IUS was attempting to propel TDRS into geosynchronous orbit. The TDRS/IUS combination began tumbling out of control. Engineers succeeded in separating the two and in stabilizing TDRS; however, the spacecraft remained in an elliptical orbit. Fifty-eight days later, the spacecraft was maneuvered into a proper orbit, where it is now operational.

Due to these tests and evaluations, the Air Force has had to postpone two of its Shuttle/IUS missions that were originally scheduled for November, 1983, and July, 1984. NASA has had to postpone its launch of TDRS-B and -C until at least 1985.

NASA is currently scheduled to use the IUS on its first four TDRS missions.

The payload assist module (PAM) program is to provide low-cost transportation, principally for commercial spacecraft, from the Shuttle's low Earth orbit. The Delta class PAM-D is capable of injecting up to 2,750-pound payloads into geosynchronous transfer orbit. PAM-DII is being developed commercially and will be capable of placing a 4,100-pound payload into geosynchronous transfer orbit and will be available for launch by mid-1985. The Atlas-Centaur class (PAM-A) well be capable of inserting 4,400-pound payloads into the same orbit and will be system qualified by mid-1984. Eleven PAM-D's have been successfully launched atop the Delta expendable launch vehicle and five more were successfully flown on STS-5, STS-7, and STS-8. However, on STS-10 in February, 1984, on two successive days, two communication satellites were boosted into incorrect orbits by a PAM-D. After each of the two communications satellites had been properly ejected from the cargo bay, the PAM-D perigee motor failed to burn for the requisite time, due to a presumed defect in the carbon/carbon engine nozzle.

Failure analysis of the two PAM-D mishaps is currently underway in NASA.

The transfer orbital stage (TOS) is a three-axis stabilized perigee stage that is being commercially developed by the Orbital Science Corp. (OCS) for use in the Shuttle. It will have the capability of placing 6,000 to 13,0.00 pounds into geosynchronous transfer orbit and thus bridge the gap between PAM-DII and Centaur. The scheduled lunch availability is late-1987. A TOS is planned to be used to launch the Mars geoscience/climatology orbiter. NASA is monitoring the development of the TOS prior to acquiring flight hardware for the MGCO mission.

In payload operations and support equipment, payload integration support and payload-related hardware are developed and furnished for NASA payloads. A key achievement this year was the retrieval/repair mission of the solar maximum mission spacecraft which was undertaken with funding supplied by both NASA and the Department of Defense (DOD). Multi-mission payload equipment being developed includes a payload bay bridge structure to carry small payloads, apparatus for providing cooling of the heat generated in the orbiter bay by the radioisotope thermal generators (RTG's) used for planetary missions, and a standard mission cable wire harness for mixed cargos.

The advanced programs effort, in addition to specific space station activities involving studies of station assembly and hardware commonality, will be focused on five major areas—satellite services, unmanned platforms, advanced transportation systems, crew systems, and generic space systems capabilities. Satellite servicing systems will continue definition and advanced development work in remote and proximity operations. Continued efforts will be made in the areas of platform systems and servicing and advanced tether applications. Advanced transportation concepts will be studied including orbital transfer vehicles (OTV's), propellant management, advanced launch vehicles, and advanced STS analytical tools. Systems supporting human presence in space as well as generic work in space structures, orbital debris management and retrieval, and advanced avionics will be investigated.

The tethered satellite system (TSS) hardware development will begin in fiscal year 1984. An announcement of opportunity was issued on April 15, 1984 and, if the schedule progresses as planned, selections of the first three flights will be made by October 1984. The Italians will also initiate hardware development in fiscal year 1984 leading to a cooperative first flight in December 1987.

Committee comment

Acknowledging that neither the inertial upper stage (IUS) nor the PAM-D upper stage were developed by NASA, the Committee regrets the impact that the anomalies associated with the IUS and the PAM-D upper stages failures in April, 1983 and February, 1984 respectively, have had and may continue to have on the Shuttle delivery schedule and on NASA's communications capabilities.

At this time, it is unclear to what extent these upper stage anomalies may represent a serious national problem for our space transportation system (STS). While the Committee is satisfied with the attempts to date to resolve the problems associated with the anomalies, the Committee would also urge NASA to assume the responsibility of reexamining our national upper stage technologies and capabilities to determine if the current mix of upper stages is adequate to support the needs of NASA's civilian and DOD customers. This reevaluation should also take into consideration the upper stages that are presently being designed and developed for future use. The Committee expects to be kept informed on a timely basis of the findings and conclusions of this reexamination.

Furthermore, the Committee expects that the funds provided within space transportation capability development for upper stages may be used for alternative upper stage technologies where deemed appropriate. Given the uncertainties that exist in our present upper stage technologies, the Committee does not want to preclude any potential design or configuration from consideration in fulfilling our STS upper stage requirements.

In the past, the Committee has supported the development of an orbital maneuvering vehicle (OMV) for the unique capabilities it will provide to our baseline STS orbital operations. The Committee awaits the award of the three contracts for definition studies for an OMV and emphasizes its interest in the OMV as an important adjunct to our Space Shuttle operations and to the development and operations of a space station.

Because certain STS missions, such as the Space Telescope launch, the tracking and data relay satellite (TDRSS) B and C launches, and other payload missions have been delayed from their originally scheduled launch dates, the Committee has recommended a funding decrease of $5 million from the administration's budget request for payload operations and support equipment. The Committee believes that the resulting authorization of $56,300,000 will adequately support the agency's STS payload operations during 1985.

SPACE STATION—$150,000,000

The Committee has authorized $150 million for fiscal year 1985 as follows:

Summary of funding levels, fiscal year 1985

Utilization requirement	$14,100,000
Supporting studies from program support	12,200,000
Focused technology	34,200,000
Advanced development	20,200,000
Flight experiments	11,000,000
Systems definition/integration	58,300,000
Total	150,000,000

The U.S. space station will establish a permanent human presence in space to expand the exploration and use of space for activities which enhance the welfare and security of mankind. The program is built upon the operational capabilities of the Space Shuttle and represents the next logical step in U.S. space capability development. The program is responsive to the basic goals of the President's National Space Policy which calls for U.S. leadership in space and economic and scientific benefits through the exploration of space. The station, once operational, may also provide a staging base for succeeding major national steps in space such as manned missions to the Moon or planets, or unmanned scientific probes and sample returns.

The U.S. space will be a multipurpose facility providing a permanent human presense in space to conduct essential scientific and technical research, to perform unique commercial activities, and to perform more efficiently operational tasks in space, such as satellite servicing construction and servicing of platforms, and placement of spacecraft into higher orbits. The space station will have both manned and unmanned elements and will involve extensive national and international user community participation in such areas as science, applications, manufacturing, communications, satellite servicing, and, potentially, in national security. From the outset of the program definition effort, the space station itself will incorporate a modular design philosophy which will permit the system to evolve through time, to provide greater user utility through simplified user interfaces and improved capability for on-orbit crew maintenance and operational autonomy in order to achieve effective long-term performance. Implicit in these objectives is the recognized need to optimize the synergistic effects of the man/machine combination in space via automation, robotics, and artificial intelligence technolgy. It will provide essential system elements and operation practices for an integrated national space capability. The space station facility (core and associated platforms) will be placed and maintained in low-Earth orbit by the space transportation system.

A basic premise of the space station program is to perform a thoroughly detailed front-end definition including: Engineering design by industrial contractors; subsystem advance development and tests in dedicated test beds; early flight experiments on the Space Shuttle to prove system feasibility; and continued trade studies for system optimization. Extensive engineering definition incorporated directly into hardware specifications provides the greatest single assurance of program success and the achievement of cost targets. Throughout the definition period, significant effort will be focused on growth potential and modular configurations to insure that the initial station will be capable of evolutionary growth in both size and technology. Following an extensive definition program, consisting of both in-house and contracted activities, development will begin in fiscal year 1987 with orbital activities beginning in the early 1990's.

BASIS OF FISCAL YEAR ESTIMATE

Utilization requirements.—This activity develops function and user operational requirements based on both national and international missions. These requirements specify customer needs in terms of power, volume, services, heat communications, et cetera. The objective of gathering this data now is to insure that the space station and supporting ground systems are "user friendly."

Supporting studies and program support.—Analysis of space station architecture and preliminary system and subsystem requirements are driven by and complement the ongoing and in-house trade study efforts in such operations as: Auxiliary propulsion, maintainability of the system, and thermal control systems definition. Studies will be performed to define the space station requirements of elements in assembling the space station as well as servicing satellites and the necessary operations associated with these tasks. Also, planned studies will determine the feasibility and the potential cost savings achievable from space station hardware commonality.

Focused technology.—This effort builds upon a generic technology base and focuses the technology development in those areas that will support space station development. The approach is to define requirements and timeliness for space station implementation, to develop options for space station application and to carry enhancing and enabling technologies into brassboard prototype programs, that is, advanced development.

Advanced development.—This program provides the "transfer" function between technology and system development. The approach is to select high leverage technologies from the focused technology program for brassboard/prototype demonstrations to evaluate technology alternatives, to quantity their respective performance and estimate their development risk from both cost and schedule standpoints. This test and demonstration activity will be conducted in test beds which will be developed along major subsystem disciplines. The initial technology test beds will be the following: environmental control/regenerative life support; electric power generations, storage, and distribution; thermal management; operating/data/management; attitude control; on-board propulsion; and space operations mechanisms.

Flight experiments.—The purpose of this activity is to use the unique space environment provided by the Space Shuttle to validate the performance of critical components and subsystems which cannot be validated in ground tests in order to verify and quantify calculated performance, to identify unforeseen anomalies, and to update engineering design criteria. It will also demonstrate techniques, sensors, tools, and procedures required for space station control, maintenance, and repair and servicing operations.

Systems definition/integration.—This effort provides for the analysis and engineering design to define the various elements that will make up the space station. Conceptually, these elements consist of various modules such as the habitability, logistics, resource and laboratory modules, and the various subsystems such as power, propulsion, data management, communications, and environmental control/life support systems. This effort will be divided into two to four work packages to be competed among industry with contracts to be awarded in fiscal year 1985.

Committee comment

Recognizing the unique capabilities and potential benefits that a permanently manned civilian space station could provide, the Committee welcomes the administration's proposal to develop a permanently manned space station within a decade. Furthermore, the Committee has had a forerunning involvement in the issue to develop a civilian space station. In November 1983, the Subcommittee on Science, Technology, and Space held a hearing on this issue, and in December, the Chairman of the Science Subcommittee, Senator Gorton, wrote a letter to the President advocating the development of a permanently manned civilian space station, a position strongly endorsed by the subcommittee's ranking Democrat, Senator Heflin. In the eyes of the Committee, a space station would do much to:

1. Ensure U.S. civil leadership in space during the 1990's;
2. Stimulate the development of advanced aerospace technologies;
3. Develop fully the commercial potential of space;
4. Provide a versatile, efficient system for space science and applications;
5. Couple maturing international space programs to U.S. space systems, and provide a vehicle for international cooperation in space;
6. Enable man to function routinely and more efficiently in space, to build upon previous national investments, and to enable activities now not possible;
7. Increase prestige at home and abroad;
8. Stimulate interest in scientific and technical education;
9. Maintain continuity in and focus to the Nation's civilian space program; and
10. Provide options for future national endeavors.

As Mr. James Beggs, the administrator of NASA, testified at the Committee's hearing on February 28, 1984:

> The time for space is ripe. The agenda for tasks which can be undertaken and enhanced using the unique capabilities of the space station is full, and both the U.S. industry and the NASA institution are fully prepared to implement the President's initiative. The station is, I believe, the next logical step.

The Committee also believes that a space station is the next logical step and that such an initiative is well-timed, given the increasing operational capability and maturity of the Space Shuttle.

Furthermore, the Committee is convinced that a permanently manned space station is essential to maintaining the U.S. leadership in space exploration and exploitation. A space station, in the opinion of the Committee, would and could serve a varity of useful functions and purposes, including:

1. A permanent observatory to look down upon the Earth and out at the universe;
2. A transportation node where payloads and vehicles are stationed, processed, and propelled to their destinations;
3. A servicing facility were these payloads and vehicles are maintained and, if necessary, repaired;
4. An assembly facility where, due to ample time on orbit and the presence of appropriate equipment, large structures are put together and checked out;
5. A manufacturing facility where human intelligence and the servicing capability of the station combine to enhance commercial opportunities in space; and
6. A storage depot where payloads and parts are kept on orbit for subsequent deployment.

Perhaps even more important than any of these "perceived" uses of a space station are the "unperceived" uses and benefits that one cannot predict or even comprehend today. The space station is a bold step into the future, into the 21st century, and its represents a major evolutionary step in man's experimentation, use, and conquest of space.

In January of this year, the President in his State of the Union Address directed NASA to develop a permanently manned space station within a decade. This announcement by the President, as is the case with any bold new initiative, has stimulated much debate. However, from the onset, it should be clear that the concept of living and working in space is far from new. Authors wrote on the subject in the last century, and space station configurations have been studied in some depth. These concepts have ranged from elaborate configurations with artificial gravity and crews numbering several dozen to simple derivations of developed space hardware such as the Apollo command and service module. And, of course, let us not forget that just slightly more than 10 years ago, the United States orbited a precursor space station—Skylab—and that the Soviet space station that is currently in orbit—Salyut—is the seventh in a series of permanently manned Soviet space stations, the first of which was launched in 1971.

The latest space station proposal announced by President Reagan takes on added significance since it comes at a time when the Shuttle has gained increased operational capability and, therefore, NASA has enough flexibility in its budget to commerce another bold new initiative. If ever the time were ripe to develop a space station, now is the time. The required infrastructure is in place, the necessary transportation mode exists, and the degree of interest in commercial space activities by industry and foreign governments alike is at a peak.

Despite the great deal of interest in the space station proposal, the Committee is aware of the fact that there is not complete unanimity toward its development. In particular, the Committee is aware of the concerns of certain individuals within the science community. Mindful of their concerns, the Committee commends NASA for establishing the Task Force on Scientific Uses of the Space Station and urges NASA to support its space science and applications activities at a level that will permit accessible and affordable use of the space station. The Committee is aware of the concerns of the space science community during the development of the Space Shuttle and assures the community that the Committee will seek to maintain a steady level of growth in the space science and applications programs during the development of a space station. The Committee supports the assurance of "real growth" in the fiscal year 1986–89 NASA budget given by the administration and feels that this assurance makes it possible for the space science and applications programs to experience "real growth" during these years.

At the same time, the Committee feels that the recepitivity of the private sector and foreign governments to participate in the development of a manned space station should further reduce the budgetary pressures on the development of systems outside the "core" technology. The Committee, however, expects NASA to keep it well-informed as to any progress that is being made in this area and what the terms and conditions of any such financial agreements include.

The Committee is aware that it might be possible to carry out many of the early missions proposed for the space station on an unmanned basis. However, the Committee supports the contention that "it is man, not merely machines, in space that captures the imagination of the world." The Committee, therefore, supports the development of a permanently manned space station from the onset.

However, such a posture should not be interpreted to mean that the Committee supports the use of off-the-shelf technology or that the Committee does not support the development and inclusion of useful advanced automated systems in the space station. The Committee recalls that even prior to the creation of the Space Station Task Force in May 1982, a Space Station Technology Steering Committee (SSTSC) was established within NASA to assess the technologies relevant to a space station in the 1990 time frame. The SSTSC concluded that "the use of state-of-the-art technologies would result in a space station that would not have affordable growth potential and would not be cost effective for long-term life through on-orbit maintenance." The Committee, therefore, is most supportive of the automation study recently commenced by NASA and of the efforts of NASA to determine the appropriate mix of man and machine. The Committee supports the contention that while the space station will be permanently manned, it will not be able to operate in an optimally effective manner and it will not be able to fulfill the multiplicity of functions envisioned unless a plan is developed to optimally develop functions between man and automated elements.

From the beginning, the space station has been characterized as a facility that would be used only for peaceful purposes. In the "President's Plan for Space—A Partnership for Progress", the Administrator of NASA stated that the President's program "leaves no doubt that the United States means business in expanding our presence in space, not only for our own benefit, but for the benefit of peace-loving people around the world * * *" and that "the President's new international initiative will deepen our commitment to working with all nations to explore the peaceful uses of space." Furthermore, during the Committee's hearings, DOD stated that it had not yet identified any military requirements for military space station operations and that it had no desire to take any kind of preemptive rights on a civilian space station.

In light of this testimony and the administration's characterization of the space station as a facility to be used for peaceful purposes, the Committee feels it is appropriate to include language in the fiscal year 1985 NASA authorization that reaffirms the commitment of the United States to the peaceful use of space. Section 107 of S. 2612 and of H.R. 5154, as reported by the Senate Commerce Committee, therefore, restates Articles IV of the 1967 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies. While the language included in the Committee bill does not preclude DOD from conducting research and development activities on the space station, it would prohibit the installation of nuclear weapons of mass destruction on the space station.

In general, the Committee is most pleased with NASA's space station proposal. The Committee compliments NASA and especially the members of the Space Station Task Force for the focus and direction they have given to planning a space station. The Committee expects to be kept well-informed during the course of development of the space station as to any new developments in the program, the proposed schedule and budgetary requirements, the proposed timing and content of requests for proposals and contractual agreements, the result and consequences of NASA space station studies and evaluations, and the extent of foreign interest and involvement. To initiate the extended definition and design studies, the Committee authorizes $150 million in fiscal year 1985 for the space station, the full amount requested by the administration.

SPACE SCIENCES—$1,065,400,000

The Committee authorization for the space sciences—physics and astronomy, life sciences, planetary exploration—is $1,065,400,000, $38 million more than the fiscal year 1985 administration request.

PHYSICS AND ASTRONOMY—$705,200,000

The Committee recommends $705,200,000 for physics and astronomy, compared to the administration's request of $677,200,000. This $28 million increase is allocated between research and analysis ($14 million) and Shuttle/Spacelab payload development and mission management ($14 million).

Summary of funding levels, fiscal year 1985

Space Telescope development	$195,000,000
Gamma Ray Observatory development	120,200,000
Shuttle/Spacelab payload development and mission management	119,400,000
Explorer development	51,900,000
Mission operations and data analysis	109,100,000
Research and analysis	50,900,000
Suborbital programs	58,700,000
Total	705,200,000

The major objective of the physics and astronomy program is to increase our knowledge of the origin, evolution, structure and composition of the universe, including the Sun, the stars, and the other celestial bodies. Space-based research is being conducted to investigate the structure and dynamics of the Sun and its long- and short-term variations; cosmic ray, X-ray, ultraviolet, optical infrared, and radio emissions from stars, interstellar gas and dust, pulsars, neutron stars, quasars, black holes and other celestial sources; and the laws governing the interactions and processes occurring in the universe. Many of the pehnomena being investigated are not detectable from ground-based observatories because of the obscuring or distorting effects of the Earth's atmosphere.

To achieve the objectives of the physics and astronomy program, NASA employs theoretical and laboratory research; aircraft, balloon and sounding rocket flights; Shuttle/Spacelab flights; and free-flying spacecraft. Research teams involved in this program are located at universities, industrial laboratories, NASA field centers, and other Government laboratories. The scientific information obtained and the technology developed in this program are made available to the scientific communities for the application to and the advancement of scientific knowledge, education and technology.

The physics and astronomy missions undertaken to date have been extraordinarily successful, and a number of missions continue to produce a rich harvest of scientific data—the International Ultraviolet Explorer (IUE) and the Solar Maximum Mission (SMM) are still operating and new scientific results are continually emerging from the analysis of the High Energy Astronomical Observatories (HEAO) and Infrared Astronomical Satellite (IRAS) data sets.

Space Telesope

The Space Telesope will make a major contribution to understanding the stars and galaxies, the nature and behavior of the gas and dust between them, and the broad question of the origin and scale of the universe. Operating in space above the atmospheric veil surrounding the Earth, the Space Telescope will increase by several hundredfold the volume of space accessible for observations. With its significant improvements in resolution and precision in light sensitivity and in wavelength coverage, the Space Telescope will permit scientists to conduct investigations that could never be carried out using ground-based observatories due to the obscuring and distorting effects of the Earth's atmosphere. The Space Telescope will enhance the ability of astronomers to study radiation in the visible and ultraviolet regions of the spectrum. It will be more sensitive than ground-based telescopes and will record greater detail about the objects under study. It will make possible observation of objects so remote than the light will have taken many billions of years to reach the Earth. As a result, we will be able to look far into the distant past or our universe. The Space Telescope will also contribute significantly to the study of the early state of stars and the formation of solar systems, as well as to the observation of such highly evolved objects as supernova remnants and white dwarfs stars. With the Space Telescope, we may be able to determine the nature of quasars and the processes by which they emit such enourmous amounts of energy, and it may also be possible to determine whether some nearby stars have planetary systems. The Space Telescope will be an automated observatory, delivered into orbit by the Space Shuttle. Data from its scientific instruments will be transmitted to Earth via the tracking and data relay satellite system. The Space Telescope design will permit in-orbit maintenance, repair, and retrieval by the Space Shuttle for return to Earth, refurbishment, and reuse.

During fiscal year 1983, the primary mirror assembly was completed and integration of the optical telescope assembly began. Most of the support system module has been fabricated. All of the scientific instruments have been delivered to the Goddard Space Flight Center for verification and acceptance testing, which is now in progress.

In fiscal year 1984, the Space Telescope system fabrication, integration and testing efforts will continue. In particular, the optical telescope assembly (OTA) integration and testing activities will be continued leading to delivery of the OTA to Lockheed in early fiscal year 1985 for integration with the support system module.

The fiscal year 1985 funding is required to complete the integration and testing of the optical telescope system and its subsequent delivery to Lockheed where it will be integrated with the support systems module. In addition, the entire Space Telescope system integration and testing will be initiated leading to the launch of the ST in the second half of 1986 rather than the first half of 1985 due to technical problems encountered during fiscal year 1983, particulary with the optical telescope assembly.

Gamma Ray Observatory

The objective of the Gamma Ray Observatory (GRO) mission is to measure gamma ray radiation from the universe and, thus, to explore the fundamental physical processes powering it. Certain celestial phenomena are accessible only at gamma ray energies. The observational objectives of the Gamma Ray Observatory are to search for direct evidence of the synthesis of the chemical elements; to observe high energy astrophysical processes occuring in supernovae, neutron stars and black holes; to locate gamma ray burst sources; to measure the diffuse gamma ray radiation for cosmological evidence of its origin; and to search for unique gamma ray-emitting objects. Gamma rays represent one of the last fronties of the electromagnetic spectrum to be explored because the required technology has only recently been developed. The low flux levels of gamma ray quanta, and the high background they produce through their interaction with the Earth's atomosphere, coupled with the demand for better spectral, spatial, and temporal resolution of source features, combine to require that large gamma ray instruments be flown in space for a problonged period. Gamma rays provide unique information on the most intriguing astronomical objects yet discovered, including guasars, neutron stars, and black holes. The Gamma Ray Observatory will be launched by the Space Shuttle in 1988. The spacecraft is designed to accomodate four large gamma ray instruments. The instruments will have their principal axis pointing in the same direction, and the spacecraft will point these instruments in a fixed direction in space for long periods (hours to weeks).

In fiscal year 1984, instrument critical design reviews will be held for the GRO instruments, as will the preliminary design review for the spacecraft. In addition, fabrication of the spacecraft and instrment hardware will be initiated. The fical year 1985 funding is required for continuation of the major fabrication and assembly efforts on both the instruments and the spacecraft, and for completion of the total mission critical design review.

Shuttle/Spacelab payload development and mission management

The objectives of Shuttle/Spacelab payload development and mission management are to acquire new knowledge in the disciplines of physics and astronomy and to mange the mission planning and execution of the complete NASA Spacelab payload program. The funding provides for the development of all physics and astronomy Spacelab experiments, the system management and engineering development of the flight equipment and software, the payload specialist support, the physical integration of the payload with the Spacelab system, the operation of the payloads during flight, the dissemination of data to experimenters, and the analysis of physics and astronomy flight data. In addition, this funding supports mission managfement efforts for all NASA Spacelab payloads.

Instruments are currently under development for several Shuttle/Spacelab missions with primary emphasis on physics and astronomy. Spacelab-2, an all-pallet configuration, is scheduled to fly in 1985. The objectives of spacelabp-2 are to verify the Spacelab igloo and pallet systems and to obtain scienfific data, with emphasis on astrophysics and solar physics. The instrument pointing system, developed by the European Space Agency, will be used for the first time on the Spacelab-2 mission.

Three ultraviolet telescopes are also currently in development leading to a launch in 1986 (Astro-1). This mission is designed to conduct investigations in ultraviolet imaging, spectrophotometry, and polarimetry at very high resolution. The Astro-1 mission will also carry two widefield cameras, to conduct unique scientific observations of Halley's Comet in the near-Earth environment. Astro-1, as well as reflights of this instrumentation, are designed to allow scientific investigations of a broad range of objects, from nearby comets and planets to the most distant quasars.

Spacelab 3, primarily a materials processing and life sciences mission, will be flown in late 1984.

In fiscal year 1985, mission management of the ongoing Spacelab mission will be continued. Definition of the Solar Optical Telescope will be continued in fiscal year 1985, and development of the Space Plasma Lab will be continued. In addition, fiscal year 1985 funding is required for the continuation of development and testing activities on the Spacelab-2 hardware, hardware for the three ultraviolet telescopes which will be flown on ASTRO-1 in 1986, on OSS-2 which will be flown in 1987 and refurbishment of some hardware which was flown on Spacelabs 1 and 2. Fiscal year 1985 funding is also required for the development of low-cost sounding rocket class payloads which will be flown on the Space Shuttle to provide more flight opportunities to the science community at a relatively low cost.

Explorer

The Explorer program provides the principal means of conducting astronomical studies and long-term investigations of solar physics and of the near-Earth interplanetary environment having limited, specific objectives and not requiring major observatories. Included in the present program are missions to study atmospheric and magnetospheric physics; the several magnetospheric boundaries; interplanetary phenomena; and X-ray, ultraviolet, and infrared astronomy. Studies are conducted to define future high priority science explorer missions. NASA engages in cooperative missions with other Federal agencies and other nations whenever such cooperation will assist in achieving mission objectives. Solar terrestrial and atmospheric explorers provide the means for conducting studies of the earth's near-space environment. The program requires a wide variety of satellites in orbits extending from the very lowest reaches of the upper atmosphere, to the interplanetary medium beyond the Earth's magnetosphere. Efforts in fiscal year 1984 include launch of the San Marco–D mission and launch of the Active Magnetospheric Particle Tracer Explorer. The San Marco–D mission, a cooperative project with Italy, will include a group of U.S. experiments to study the relationship between solar activity and the Earth's meterological phenomena. The Active Magnetospheric Particle Tracer Explorer, a cooperative project with the Republic of Germany, will involve the use of two spacecraft, one built by the United States, and one built by Germany. The mission will study the solar wind at the subsolar point and will identify particle entry windows, energization processes and transport processes into the magnetosphere.

Astrophysics explorers have been instrumental in conducting the first astronomical sky surveys in the gamma ray, X-ray, ultraviolet and low frequency radio regions of the electromagnetic spectrum. A prime example is the Infra-Red Astronomical Satellite, which has just completed a highly successful survey mission. In fiscal year 1984, development will continue on the Cosmic Background Explorer (COBE) and on the X-ray imaging instrument to be flown on the German Roentgen Satellite (Rosat). COBE will carry out a definitive all-sky exploration of the diffuse cosmic background radiation of the universe between the wavelengths of 1 micrometer and 9.6 millimeters. The detailed information that COBE will provide on the spectral and spatial distribution of low energy background radiation is expected to yield significant insights into basic cosmological questions of the origin and evolution of the universe.

Rosat, a cooperative project between the Federal Republic of Germany and the United States, will perform high resolution imaging studies of the X-ray sky. The United States will provide a high resolution imaging instrument and launch services, and Germany will provide the spacecraft and instrumentation.

Funding in fiscal year 1984 will support, among other things, initiation of the Extreme Ultraviolet Explorer (EUVE), which will carry out the first detailed all-sky survey of ultraviolet radiation between 100 and 900 angstroms—a hitherto unexplored portion of the electromagnetic spectrum.

Fiscal year 1984 funding is also supporting definition studies for future candidate explorer missions, including the X-ray Timing Explorer and the Far Ultraviolet Spectroscopy Explorer. Studies are also being conducted on potential alternate lower cost spacecraft concepts for future explorers.

Fiscal year 1985 funding is required for continued development activity on the Cosmic Background Explorer, the Extreme Ultraviolet Explorer, the Rosat instrument, the Cosmic Ray Isotope Experiment, and the instrumentation for the reflight of the Long Duration Exposure Facility to obtain cosmic ray data. Fiscal year 1985 funding will also provide for definition studies of future potential explorer missions.

Mission operations and data analysis

The purpose of the mission operations and data analysis effort is to conduct operations and to analyze data from the physics and astronomy satellites after launch. This program also supports the continued operation of a number of spacecraft, after their originally planned objectives have been achieved, for purposes of conducting specific investigations that have continuing, high scientific significance. The funding supports the data analysis activities of the many investigators at universities and other research organizations associated with astrophysics and solar terrestrial operational satellite projects. Actual satellite operation, including operation control centers and related data reduction and engineering support activities, is typically carried out under a variety of mission support or center support contracts.

In addition to the normal support required for mission operations, the Space Telescope program encompasses several unique aspects which must be provided for well in advance of launch. The Space Telescope is designed for operation for more than a decade, based on in-orbit maintenance, recovery, refurbishment, and relaunch and in-orbit changeout of the scientific instruments. During the operational period, the Space Telescope will be used primarily by observers selected on the basis of proposals submitted in response to periodic solicitations. Science operations will be carried out through an independent Space Telescope Science Institute. The institute will operate under a long-term contract with NASA. While NASA will retain operational responsibilities or the observatory, the institute will implement NASA policies in the areas of planning, management, and scheduling of the scientific operations of the Space Telescope.

Fiscal year 1985 funds will provide support for the basic mission operations and data analyses activities for the Active Magnetospheric Particle Tracer Explorer, continued operation and data analysis activities for the International Ultraviolet Explorer, and continued analysis of the extensive data obtained by the Infrared Astronomical Satellite and the High Energy Astronomy observatories. Fiscal year 1985 funding will provide for the continued operation of the repaired Solar Maximum Mission, and preparation for the operation of the Space Telescope. In fiscal year 1985, the development of mission operations procedures as well as development of the science operations ground system for the Space Telescope will be continued. The Space Telescope Science Institute activities will be continued leading to operational capability through the continued development of the guide star selection system and science data analysis software. In fiscal year 1985, maintenance and refurbishment planning activities such as the purchase of orbital replacement units and space support equipment will be continued to allow for the capability to service the Space Telescope in orbit.

Research and analysis

The research and analysis program provides for the research and technology base necessary to define, plan, and support flight projects. Preliminary studies to define missions and-or payload requirements are carried out as are theoretical and ground-based supporting research and advanced technology deveopment (ATD). Activities included are supporting research and technology (SR&T), ATD and data analysis.

During fiscal year 1985, the supporting research and technology program will support those tasks which contribute to maintaining a firm base for a viable physics and astronomy program. Emphasis will be placed on infrared detector development and on expansion of technology activities related to large X-ray mirrors, advanced X-ray detectors, gamma ray spectrometers and instrumentation. Emphasis will also be placed on the development of a large array multichannel plate, and on intensified charge-coupled imagery devices. In the area of solar physics, activities will support the Solar Maximum Mission, especially through theoretical studies of high energy phenomena. Thrusts in the development of advanced generation instrument concepts will continue especially for the extreme ultraviolet and X-ray wavelengths, and for analyzing the structure and dynamics of the solar interior.

Fiscal year 1985 funding will also support continued reasibility and definition studies on future potential candidate missions such as the Advanced X-ray Astrophysics Facility and the Solar Dynamics Observatory as well as the definition of new Spacelab payload. In the data analysis activities to be carried out at universities and Government research centers in fiscal year 1985, emphasis will be placed on correlative studies involving data acquired from several sources (spacecraft, balloons, sounding rockets, research aircraft and ground observatories).

Suborbital programs

The suborbital program provides versatile, relatively low-cost research tools that complement the capabilities of balloons, aircraft, free-flying spacecraft and the Space Shuttle in all the space science disciplines, including the study of the Earth's ionosphere and magnetospere, space plasma physics, steller astronomy, solar astronomy, and high energy astrophysics. Activities are conducted on both a domestic and international cooperative basis.

Committee comments

The Committee has historically supported NASA's space science programs and continues to believe that capitalizing on space requires a firm commitment to these programs. Therefore, the Committee rejects the level of funding in the administration's budget request for two physics and astronomy programs—research and analysis, and Shuttle/Spacelab payload development and mission management.

In response to this budget request, the Committee has authorized an additional $14 million for research and analysis. Of this amount, $6 million is allocated for advanced technology development (ATD) funding for the Advanced X-ray Astrophysics Facility (AXAF), which was the top priority new program for the 1980's of the Astronomy Survey Committee of the National Research Council. AXAF is a follow-on the highly successful Einstein (HEAO)-2 Observatory and will fulfill the need for a long-lived satellite observatory with the capabilities for X-ray astronomy.

Within the augmentation for research and analysis, the Committee authorizes an additional $3 million for ATD funding for Gravity Probe-B for a total of $8 million. Gravity Probe-B has been indentified by the National Academy of Science Space Science Board as the leading free-flyer relativity mission for the 1980's. Gravity Probe–B will initially be tested as a Space Shuttle experiment and will subsequently provide two completely new tests of Einstein's

General Theory of Relativity, which is the basis of our current understanding of the universe.

Recognizing the importance of theoretical astrophysics to the design and performance of future space science missions, the Committee authorizes an additional $3 million for supporting research and technology in the field of theoretical astrophysics. These theoretical studies are vital to establishing the crucial scientific questions to be addressed by observation and to supporting NASA astrophysics research in universities.

Finally, within research and analysis, an additional $2 million is authorized by the Committee for university instrumentation and laboratory equipment. The 1983 report of the NASA/University Relations Study Group, entitled "The Universities and NASA Space Sciences," has identified aging university laboratory equipment and instrumentation as a national problem that could affect the quality of space science research conducted at our universities. While the Committee recognizes that a modest investment of $2 million to physics and astronomy research and analysis will not completely rectify this instrumentation problem, the Committee hopes that this augmentation will have a positive impact and that in the future NASA will assume a greater responsibility in resolving this problem.

Cognizant that funding for Shuttle/Spacelab payload development and mission management is critical to the development of instruments and experiments that will be launched as NASA payloads, the committee has authorized an additional $14 million in Fiscal Year 1985 for these activities. Of this amount, $6 million is allocated for ATD for the Solar Optical Telescope (SOT), which has been established as the major initiative in support of solar physics for the remainder of the century. During Fiscal Year 1984, funds were reprogramed from SOT to Space Telescope to accommodate the Space Telescope overruns identified in early 1983. This $6 million augmentation is to position SOT more closely to its original development schedule and to partially recover the impact of Fiscal Year 1984 reprograming.

The Committee understands NASA's concerns over the fact that both the Space Telescope and SOT had been contracted to the same development firm. However, now that the Space Telescope management and budgetary problems have been mitigated, the Committee would urge NASA to proceed with the development of SOT is a manner consistent with its original schedule.

Four million dollars of the Committee's $14 million augmentation to Shuttle/Spacelab payload development is for Shuttle Infared Telescope Facility (SIRTF) ATD. The spectacular success of the Infrared Astronomical Satellite (IRAS) underscored the importance and timeliness of a follow-on cryogenically cooled infrared facility in space. SIRTF will become the first facility class space infrared observatory and will be able to study celestial phenomena ranging from the most energetic bodies in the universe to newly formed stars and planets.

Finally, within Shuttle/Spacelab payload development, the Committee authorizes ana additional $4 million for Space Plasma Lab ATD. Unlike most plasma studies which are passive observations, the Space Plasma Lab will afford the possibility of using active probing and perturbation techniques. The augmentation is to minimize the impact on the program from any slippage in the mission.

After having recently received a briefing on the Space Telescope development by the NASA Marshall Space Flight Center project manager, the Committee is pleased to learn that NASA is presently on schedule for a November 1984 delivery of the Space Telescope's optical telescope assembly to Lockheed. Further, the Committee is pleased to learn that all management and budgetary problems identified in early 1983 are currently under control and that the June 1986 Space Telescope launch is still achievable.

LIFE SCIENCES—$63,300,000

The Committee has authorized $63,300,000 for fiscal year 1985, the same amount as the administration requested, as follows:

Summary of funding levels, fiscal year 1985

Life sciences flight experiments	$27,100,000
Research and analysis	36,200,000
Total	63,300,000

The goals of the life sciences program are to provide a sound scientific, medical, and technical basis for safe and effective manned space flight, and to advance the understanding of the basic mechanisms of biological processes by using the unique capabilities of the space program. Results from the research program are applied to: the immediate needs in the maintenance and health of the astronauts; understanding the response of biological systems to weightlessness; the design of the advanced life support systems for use on future missions; and understanding the biosphere of the planet Earth, its origin, evolution, and present state.

The life sciences program is the key to developing a capability to sustain a permanent manned presence in space and to utilize the space environment to study living systems. These activities include both ground-based and space research efforts which are mutually supportive and integrated, and use a composite of disciplines and techniques in both biology and medicine to address space-related medical problems and fundamental biological processes.

Life sciences flight experiments

The objective of the life sciences flight experiments program is to assimilate information and scientific questions from the various life sciences disciplines and translate them into payloads designed to expand our understanding of the basic physiological mechanisms involved in adaptation to weightlessness. The program includes selection, definition, inflight execution, data analysis, and reporting of medical and biological investigations.

Current activities involve the development of life sciences flight experiments to be flown on Spacelabs 2, 3 and 4 and the German-D1 mission (Spacelab D1). Most of the experiments onboard the early Shuttle flights will serve as pathfinding activities for Spacelab-4, the first Spacelab mission dedicated entirely to life sciences investigations. Hardware and experimental protocols for flights through Spacelab-3 are well developed. Activities on Spacelab-3 will involve evaluation of functional performance and compatibility of hardware that is essential to human and animal investigations which will be conducted on Spacelab–4. Hardware development and mission planning activities are proceeding on schedule for the U.S. vestibular experiment which will be flown on the German–D1 mission; these are follow-up investigations to those conducted on Spacelab–1.

Fiscal year 1985 funding is required for the continuing definition and development of hardware which will be flown on future Spacelab missions, that is, Spacelab–3, D1,–4 and the second dedicated life sciences mission, yet to be designated. Flight hardware integration and experiment development associated with Spacelab–2,–3 and D–1 will be completed in preparation for launches in 1984 and 1985. Final experiment selection of investigations for Spacelab–4 is now in process. In addition, the selection process for experiments for the follow-on dedicated Spacelab life sciences missions has been initiated through the recent release of a new flight announcement of opportunity (AO).

Research and analysis

The research and analysis activity of the life sciences program is concerned, in part, with ground-base research in basic biology and in those medical problem areas that affect manned spaceflight. The program is comprised of six elements: (1) operational medicine; (2) biomedical research; (3) advanced life support systems research; (4) gravitational biology; (5) exobiology; and (6) biospheric research. The life sciences operational medicine program is responsible for bringing the science, technology, and practice of medicine to bear on solving the problems of sustaining, supporting, and protecting individuals working in the space environment. The biomedical research program seeks to develop the basic medical knowledge needed to enable men and women to operate more effectively in space. The advanced life support systems research program concentrates on enhancing our ability to support long-duration manned presence in space and on optimizing the productivity of the STS crews.

The gravitational biology program explores the role of gravity in life processes and uses gravity as an environmental tool to investigate fundamental biological questions. The exobiology program is directed toward furthering our understanding of the origin and evolution of life, and life-related molecules, on Earth and elsewhere in the universe. The biospheric research program explores the interaction between the biota and the contemporary environment to develop an understanding of global biogeochemical cycles.

In fiscal year 1985, life sciences research and analysis activities will support the continued efforts in the six programs described above and will emphasize the formulation of improved approaches to the operational management of space adaptation syndrome.

PLANETARY EXPLORATION—$296,900,000

The Committee authorization of $296,900,000 for fiscal year 1985 is $10 million above the administration's request. The additional funding is entirely for research and analysis.

Summary of funding levels, fiscal year 1985

Galileo development	$56,100,000

Venus radar mapping mission	92,500,000
International Solar Polar Mission	9,000,000
Mars Geoscience/climatology orbiter (MGCO)	16,000,000
Mission operations and data analysis	58,800,000
Research and analysis	64,500,000
Total	296,900,000

The planetary exploration program encompasses the scientific exploration of the planets and their satellites, comets and asteroids, and the interplanetary medium. The program objectives are: to understand the origin and evloution of the solar system; to understand better the Earth through comparative studies with other planets; and to understand how the appearance of life in the solar system is related to the chemical histroy of the system. The projects undertaken in the past have been highly successful. The strategy that has been adopted calls for a balanced emphasis on the terrestrial-like inner planets, the giant gaseous outer planets, and the small bodies (comets and asteroids). Missions to these planetary bodies start at the level of reconaissance and exploration to achieve the most fundamental characterization of the bodies, and proceed to a level of detailed study. The reconnaissance phase of inner planet exploration began in the 1960's and has now been completed, though we still know little about the nature of Venus surface. Mars has provided program focus because of its potential as a site of biological activity. The Viking landings in 1976 carried the exploration of Mars forward to a new level of scientific and technological achievement, thereby setting the stage for next step of detailed study. Analyses of the Moon rock samples returned by Apollo continue to be highly productive as new insights into the early history of the inner solar system are achieved and as our theoretical concepts are revised accordingly. The continuing Pioneer Venus mission is carrying the study of our nearest neighbor and closest planetary analogue beyond the reconnaissance stage to the point where a basic characterization of the massive cloud-covered atmosphere of Venus has been made, including fundamental data about the formation of the planet.

The exploration of the giant outer planets began relatively recently. The Pioneer-10 and 11 flybys of Jupiter in 1973 and 1974 were followed by the Voyager-1 and -2 spacecraft. Voyager-1 encountered Jupiter in March 1979 and Saturn in November 1980. Voyager-2 flew by Jupiter in July 1979, and then Saturn in August 1981. New data on these planets, satellites, and rings have revolutionized our concepts of the formation and evolution of the solar system. Now, the Pioneer-10 and -11 and Voyager-1 spacecraft are on escape trajectories from the solar system. The Voyager-2 spacecraft is headed for an encounter with Uranus in 1986 that will provide our first look at this giant outer planet. Its trajectory will carry the spacecraft on to Neptune in 1989.

The Galileo misson, a cooperative effort between the United States and the Federal Republic of Germany, will be launched to Jupiter in 1986 by the Space Shuttle/Centaur upper stage. The payload is expected to extend our knowledge of Jupiter and its system of satellites beyond the profound discoveries of the Voyager and Pioneer missions. During 20 months of operation in the Jovian system, Galileo will have the capability to provide as many as 11 targeted encounters with the Galilean satellites, and an instrumented probe will be injected into Jupiter's atmosphere to a depth where the pressure is equivalent to 10 times the pressure exerted by the Earth's atmosphere.

During fiscal year 1984, major activities of the Galileo program will involve completion of the orbiter subsystems integration and testing, and the flight probe will be integrated with the orbiter leading to environmental testing in 1985.

The fiscal year 1985 funding will provide for completion of the environmental testing of the entire Galileo systems; final subsystem and instrument calibration verification will be initiated; and development of the ground systems and the associated software required to support operation of the spacecraft will be continued. The fiscal year 1985 funding also is required for hardware changes necessitated by recent informatioin regarding the Jovian radiation and its potential effect on the Galileo spacecraft as currently designed; based on analysis of Voyager and Pioneer spacecraft data, heavy ion flux in the vicinity of the satellite Io may be more severe than previously assumed. In addition, fiscal year 1985 funds are required to reimburse the Department of Energy for the continued development of the radioisotope thermoelectric power generators for the Galileo mission.

Venus radar mapper

The Venus radar mapper (VRM) mission, initiated in fiscal year 1984, will provide a global map of the cloud-shrouded surface of Venus. The VRM, using a synthetic aperture radar, will obtain global radar imagery of Venus with resolution sufficient to address fundamental questions regarding the origin and evolution of the planet, and will obtain altimetric and gravity data to determine accurately the gravity field, internal stresses, and density variations of the planet's interior. This data will be analyzed so that the evolutionary history of Venus can be compared with the Earth's. The VRM, scheduled for launch in 1988, will map essentially the entire planet in 243 days.

During fiscal year 1984, major effort on the Venus radar mapper program includes the initiation of the design and development activities on both the spacecraft and radar including an initiation of long-lead procurement items.

Fiscal year 1985 funds are required to complete the preliminary design for the spacecraft and radar systems, to initiate fabrication of the subsystems, to initiate development of the mission software, and to complete the radar development model.

International Solar Polar Mission

The International Solar Polar Mission (ISPM) is a joint NASA and European Space Agency (ESA) endeavor that will fly a package of experiments outside the solar ecliptic plane. The ISPM, which will provide data on the effects of solar activity on the Earth, will be launched in 1986 on the Shuttle/Centaur upper stage. ESA will provide the spacecraft and some instrumentation and NASA will provide the remainder of the instrumentation, the launch, tracking support, and the radioactive thermal power generators. The mission is designed to obtain the first view of the solar system from outside the plane in which the planets orbit the Sun. The mission will aid in the study of the relationship between the Sun and its magnetic field and particle emissions (solar wind and cosmic rays) as a function of solar latitude, thereby providing an insight into the effects of solar activity on the Earth's weather and climate. The ISPM will be launched in 1986 on the Shuttle/Centaur.

The ISPM was restructured in fiscal year 1981, from a two-spacecraft mission—one provided by the United States and one provided as ESA—to a single ESA spacecraft mission. However, the U.S. participation in the program remains substantial. NASA is developing five of the nine principal investigator instruments and three of the four European investigations have U.S. co-investigators.

During fiscal year 1983, the U.S. flight instruments were delivered to the ESA spacecraft developer for integration and system testing. All spacecraft testing has been completed, and the spacecraft is being partially disassembled for storage until launch.

Mars geoscience/climatology orbiter

The Mars geoscience/climatology orbiter (MGCO) mission is a relatively low-cost inner solar system mission which will utilize a high-inheritance, modified production line Earth-orbital spacecraft, and will have a well defined and focused science objective. The objective of the MGCO mission is to extend and complement the data acquired by the Mariner and Viking missions by mapping the global surface composition, topography, figure, gravity and magnetic fields of Mars to determine the location of volatile reservoirs and characterize their interaction with the Martian environment.

The MGCO mission, which is a fiscal year 1985 new initiative, will be launched in 1990 with the Space Shuttle and will be inserted into Martian orbit in 1991 to perform geochemical, geophysical and climatological mapping of the planet over a period of 2 years. The planning estimate for total cost of the development and mission operations is in the $300 to 375 million range.

The fiscal year 1985 funds are required to initiate the Mars geoscience/climatology orbiter spacecraft design and development activities. An existing Earth-orbital spacecraft derivative will be selected for the MGCO mission based on the recommendation of the Solar System Exploration Committee to identify lower-cost planetary exploration missions. The scientific instruments will be selected based on a very focused scientific objective. The MGCO mission is the highest priority planetary exploration mission recommended by the Solar System Exploration Committee.

Mission operations and data analysis

Since their launches in 1977, the two Voyager spacecraft have encountered both the Jupiter and Saturn systems and have achieved all of their original objectives. Voyager-1 is now on a cruise trajectory which will take it out of the solar system at a steep angle to the plane of the eclipse. The spacecraft will continue to collect data on the outer solar system environment while it also serves as a test bed for sequences and maneuvers to be used by Voyager-2 at Uranus and possibly Neptune. Voyager-2 is proceeding toward an encounter with the planet Uranus in January 1986.

Operation of the Pioneer Venus and the Pioneer 6–11 spacecraft is continuing. The Pioneer Venus orbiter is measuring the dynamic character of the upper Venus ionosphere and its solar wind interaction which resembles that of a comet. The Pioneer 6–9 spacecraft are operating in interplanetary space in solar orbit, and data is being acquired from the spacecraft when unusual solar phenomena occur or as unique scientific opportunities arise. The Pioneer 10 and 11 spacecraft are on a course that will take them out of the solar system in opposite directions while collecting data on the behavior of the diminishing solar wind. The search for gravitational evidence of a 10th planet also will be continued with these spacecraft.

Research and analysis

The research and analysis program contains five elements required to: Assure that data and samples returned from flight missions are fully exploited; undertake complementary laboratory and theoretical efforts; define science rationale and development of required technology to undertake future planetary missions; coordinate an International Halley's Comet Watch; and provide coinvestigator support to the European Space Agency's Giotto Mission to Halley's Comet. The planetary astronomy funding also provides for the continued operation of the Infrared Telescope Facility on Mauna Kea, Hawaii.

Committee comments

The Committee commends the Mars/geoscience/climatology orbiter (MGCO) new start as a welcome response by NASA to the Solar System Exploration Committee (SSEC) recommendations of 1983. This mission is an important milestone in the SSEC plan for low-to-moderate cost planetary missions which are, nonetheless, productive. However, the Committee finds it disturbing that the administration's budget request for planetary exploration research and analysis is $5 million less than the appropriated level for fiscal year 1984. While it may be difficult in this year of budgetary constraints to completely restore research analysis funding to a level that reflects an appropriate measure of growth, the Committee authorizes an augmentation of $10 million to planetary exploration research and analysis for fiscal year 1985.

Of this total augmentation, $8 million is authorized by the Committee for supporting research and technology to support the planning of future missions and data analysis from former and continuing missions. The Committee also has authorized within the total augmentation $2 million for the purchase of new equipment and instrumentation at universities for reasons similar to those expressed in the Committee comment for physics and astronomy.

The Committee also supports the SSEC recommendation for NASA to establish a level-of-effort series called the planetary observers, a program of low-cost, modestly scaled inner solar system missions using already developed, high capability Earth orbital spacecraft. Even though the budget request includes the new start for MGCO, the first mission recommended as a planetary observer, the administration failed to include the planetary observer program itself. The Committee urges NASA to implement in fiscal year 1986 the planetary observer level-of-effort as a means of providing stability, flexibility and affordability to its base program of planetary studies.

SPACE APPLICATIONS—$407,100,000

The objective of the space applications program is to conduct research and development activities that demonstrate space-related technology, systems, and other capabilities which provide down-to-Earth practical benefits. These activities are grouped in the following general areas: Resource observations, environmental observations, applications systems, materials processing in space, communications and information systems. In each of these areas, programs are being planned and conducted to contribute to the solution of pressing national, as well as international, problems and needs. The funding levels for these activities are shown in the following tables:

Summary of funding levels, fiscal year 1985

Solid Earth observations	$63,600,000
Environmental observations	228,700,000
Materials processing in space	33,000,000
Communications	65,600,000
Information systems	16,200,000
Total	407,100,000

The Committee has authorized augmentations in the following space applications activities: Environmental observations ($8 million); Materials processing in space ($10 million); and Communications ($45 million).

SOLID EARTH OBSERVATIONS—$63,600,000

The Committee authorization of $63,600,000 is identical to the administration request.

Summary of funding levels, fiscal year 1985

Shuttle/Spacelab payloads	$18,100,000
Geodynamics	29,900,000
Research and analysis	15,600,000
Total	63,600,000

The objectives of the solid Earth observations program are to develop space observations and experimentation to further the understanding of the global, physical, chemical, and biological processes involving the land areas of the Earth and interactions of the land areas with the Earth's oceans and atmosphere; to improve our ability to systematically evaluate the composition and geometry of the Earth's crust in order to increase the effectiveness of global assessment, exploration, and development of mineral and energy resources; and to increase our understanding of the Earth, its interior structure and composition, its rotational dynamics, the processes related to the movement and deformation of its crust, and the mechanisms associated with the occurrence of earthquakes. Principal elements of the program include the development of space and supporting ground systems and improved data processing and analysis techniques; sensor and technique development; as well as basic and applied research for identifying, monitoring, analyzing, and modeling the vegetated and geological features of the Earth.

The objective of the Shuttle/Spacelab payload development project is to develop, test, and evaluate Earth-viewing remote sensing instruments and systems to obtain data for solid Earth observations research. Both the Shuttle imaging radar, which was flown on the Shuttle orbital test flight in November 1981 to evaluate the utility of spaceborne imaging radar for geologic exploration, and the Shuttle multispectral infrared radiometer, which was used to determine the optimum spectral bands for surface materials classification, operated successfully. The large format camera, required for high resolution mapping applications, is being prepared for launch on the Shuttle in June 1984. The next generation Shuttle imaging radar is under development leading to a 1984 Shuttle launch.

Studies of the movement and deformation of the Earth's crust, the rotational dynamics of the Earth, and the Earth's gravity and magnetic fields provide information which is needed to: Understand the processes leading to the release of crustal strain in the form of earthquakes; improve our understanding of the formation of mineral deposit; and contribute to better understanding of the Earth as a planet. Space techniques such as laser ranging to satellites and the Moon, and vary long baseline interferometry using radio stars or satellites, are the only methods which can provide the precise measurements needed for these studies.

The multispectral linear array (MLA) advanced technology development activities are being focused on the development of a future high performance MLA instrument which can be used as a diagnostic tool for fundamental research in remote sensing. The MLA solid-state sensor has a number of significant features such as electronic scan, inherent geometric and spectral registration, and programmable high spatial and spectral resolution. The critical technology development and supporting research on the linear array instrument and the Shuttle imaging spectromenter is being continued in fiscal year 1985.

Landsat–4 was launched on July 16, 1982 to provide multispectral scanner and thematic mapper images for many applications in civil remote sensing. NOAA assumed operational responsibility for the Landsat–4 spacecraft and the multispectral scanner in January 1983. However, NASA still retains responsibility for the thematic mapper operations and data processing.

Landsat–D' (Landsat 5) was launched March 1, 1984 due to the premature failure of Landsat–4. NOAA has already assumed operational responsiblity for Landsat–5. NASA will retain responsibility for the thematic mapper operations until January 1985, at which time NOAA will assume operational responsibility.

Committee comments

The Committee believes that land remote sensing research and development activities have been underemphasized in the administraton's fiscal year 1985 budget request. With the tansfer of Landsat's operational responsibilities to NOAA and the pending privatization of the existing land remote sensing satellite system, NASA appears to have lost its incentive to continue long-term land remote sensing research and development. Regardless of the outcome of the land remote sensing privatization effort, the Committee is concerned that uncertainties associated with this initiative could result in undue curtailment of NASA research and development activities necessary to maintain long-term U.S. leadership in land remote sensing.

With Landsat-4 operating in a degraded mode and with the early launch of Landsat-5 in March 1984 to compensate for Landsat-4's condition, our country's remote sensing capabilities after 1987 are in question. With the recent on-orbit Shuttle repair of the malfunctioning Solar Maximum Mission observatory, the Committee continues its interest in the possibility of such a repair of Landsat-4 when a polar orbital launch from the Vandenberg launch site is possible. The Committee also is awaiting the results of a study it requested of NASA a year ago to determine the technical and cost implications of a Landsat-4 retrieval and repair mission.

Regardless of who ultimately assumes operational responsibilities of U.S. land remote sensing capabilities, the Committee believes that NASA still retains a role for related research and development. There will likely remain a necessary and desirable governmental role for research and development, particularly where the lead time to commercial application is too long and too costly and the associated risk is too great for private sector entities.

Therefore, the Committee urges NASA to increase its land remote sensing research and development activities with such sums as may be available in the fiscal year 1985 authorization. The Committee is awaiting the release of a National Academy of Sciences Space Applications Board study on our Nation's future strategy for remote sensing and would urge NASA to take into consideration the results of this study in developing its own remote sensing research and development strategy.

ENVIRONMENTAL OBSERVATIONS—$228,700,000

This Committee's authorization of $228,700,000 includes an increase of $8 million above the administration's request, to be allocated to space physics/and research and anaylsis.

Summary of funding levels, fiscal year 1985

Upper atmosphere research and analysis	$31,000,000
Atmospheric dynamics and radiation research and analysis	28,500,000
Oceanic processes research and analysis	19,400,000
Space physics/ATD research and analysis	24,700,000
Shuttle/Spacelab payload development	7,800,000
Earth radiation budget experiment	8,100,000
Extended mission operations	29,500,000
Interdisciplinary research and analysis	1,000,000
Tethered satellite payloads	3,000,000
Scatterometer	15,000,000
Upper atmosphere research satellite mission	60,700,000
Total	228,700,000

NASA's Envoronmental observations program has the goals of improving the understanding of processes in the atmosphere and the oceans, providing space observations of parameters involved in these processes and extending the national capabilities to predict environmental phenomena and their interaction with human activities. Because many of these phenomera are global or regional, the can be most effectively, and sometimes solely, studied from space. NASA's program includes scientific research effort splus the development of new technology for global and synoptic measurements. NASA's research statellites provide a unique view of the radiative, chemical, plasma acceleration, and dynamic processes occurring in the magnetosphere, atmosphere, and oceans.

To achieve these goals, a number of significant objectives have been established for the next decade. These include advancing the understanding of the upper atmosphere through the determination of the spatial and temporal distribution of ozone and select nitrogen, hydrogen, and chlorine species in the upper atmosphere and their sources in the lower atmosphere; optimization of the use of space derived measurements in understanding large scale weather patterns; advances in our knowledge of severe storms and forecasting capabilities; ocean productivity, circulation, and air-sea interactions; an improved knowledge of seasonal climate variability leading to a long-term strategy for climate observation and prediction; and a comprehensive understanding of the solar terrestrial connection and detailed determination of the physics and coupling between the solar wind, magnetosphere, and ionosphere.

The Upper Atmospheric Research Satellite (UARS) will place a set of instruments in Earth orbit which will make a comprehensive measurement of the state of the stratosphere, providing data about the Earth's upper atmosphere in spatial and temporal dimensions which are presently unattainable. Detailed defintion studies of the instruments have been completed, and the design and development activities have begun. In fiscal year 1985, design and development activities will be initiated on the UARS observatory.

The development of the Earth radiation budget experiment (ERBE) and the solar backscatter ultraviolet instrument development are proceeding on schedule toward a 1984 launch. NASA also is continuing to support the National Oceanic and Atmospheric Administration (NOAA) by managing the development of the NOAA and the Geostationary Operational Environmental Satellites (GOES) series on a reimbursable basis. Preparations are proceeding to launch NOAA-F in 1984.

Design and development activities will be initiated on a scatterometer, which will be flown on the Navy remote ocean sensing system (N-ROSS), in late 1988 to acquire global data.

Studies of the upper atmosphere have led to a new assessment of the impact of chlorofluorocarbons on stratospheric ozone, and a report has recently been forwarded to the Congress. The revised assessment of the predicted impact is somewhat less severe; this assessment is the result of improved measurements in our continuing program of laboratory chemical kinetics measurements.

Three-dimensional models of the stratosphere are being developed to quantify our understanding of the interrelation of chemistry with dynamics and radiation. The record of satellite ozone measurements now extends for over a decade and is being used in studies to determine if there have been long term trends in the average amount of global ozone which shields the Earth's surface from harmful ultraviolet radiation.

The ability to perform temperature and moisture soundings of the atmosphere from geostationary orbit has been demonstrated by the flight of the NASA-developed visible/infrared spin-scan radiometer and atmospheric sounder instrument on the GOES spacecraft. The opportunity afforded by geostationary orbits to observe a localized region continously will permit intensive study of the evolving temperature and moisture environment of severe local storms. Low Earth-orbit sounding capabilities are now enabling the extension of forecast reliability from 3 to 5 days. In certain situations, reliable forecasts of 8 to 10 days duration have been achieved.

Virtually all of the data from the Seasat mission has been archived and much of the Nimbus-7 ocean data has been analyzed. This information is being used to define potential low-cost approaches to the use of demonstrated ocean observing techniques to address a variety of ocean research challenges.

The Nimbus spacecraft continue to collect unique data sets to aid in the study of long-term trends of the Earth's atmosphere, oceans and polar ice. The Solar Mesosphere Explorer (SME) data collection over the last year has made a major contribution to the study of the El Chichon volcano. The Dynamic Explorer-1 spacecraft, renamed International Cometary Explorer, has completed an exploration of the Earth's geomagnetic tail and is being redirected toward the planned encounter in 1985 with the comet Giacobini-Zinner.

Committee Comments

An additional $8 million for space physics research and analysis has been authorized by the Committee to be allocated as follows: five million dollars for advanced technology development for the International Solar Terrestrial Physics (ISTP) program (formerly called the Origin of Plasmas in the Earth's Neighborhood, or OPEN) and $3 million for replacement of obsolete university laboratory equipment.

ISTP is a joint NASA/European Space Agency/Japan program designed to study the phenomena that occur in the interaction between the solar and terrestrial environments. A tentative time schedule calls for a new start of ISTP in fiscal year 1986. However, the funding requested in the administration's budget leaves in doubt the ability to proceed on this internationally agreed time schedule. The $5 million augmentation is to ensure that NASA's role in this joint effort contributes to a successful and timely initiation.

As mentioned in the Committee comment on physics and astronomy, the Committee believes that NASA should assume a greater role in replacing aging university laboratory equipment and instruments. The purpose of this $3 million augmentation is to assist in this modernization effort and to encourage greater NASA participation.

MATERIALS PROCESSING IN SPACE—$33,000,000

The Committee has authorized $33 million for Materials processing in space for fiscal year 1985, compared to the administration's request of $23 million.

The materials processing in space program emphasizes the science and technology of processing materials to understand constraints imposed by gravitational forces and the unique capabilities made possible by controlling these processes in the space environment. Ground-based research, technology development, and payload definition activities in fiscal year 1984 are being concentrated on six major processing areas: Metals and alloys, electronic material, glass and ceramics, biotechnology, combustion, and fluid dynamics and transport phenomena. These activities will provide the scientific basis for future space applications of materials processing technology as well as providing a better understanding of how these processes occur on the ground. Definition studies will be performed for Shuttle experiment combustion science, solidification and crystal growth, and blood storage. Also included are maintenance of capabilities for experimentation in drop tubes and towers, and aircraft. An outreach program, consisting of technical publications, workshops, experiment accommodation studies and support for joint endeavor and technical exchange agreements, are included in this program.

Materials experiment operations is a consolidation of ongoing activities which provide a range of experimental capabilities for all scientific and commercial participants in the material processing program. These include Shuttle mid-deck experiments, the material experiment assembly and the materials science laboratory, which is carried in the orbiter bay. These capabilities will enable users to develop different experiments in a cost-effective manner and allow a better understanding of the technical risks associated with experiment concepts before attempting to develop more complex hardware. In addition, reflight of investigations on Shuttle/Spacelab missions and the mid-deck is provided for in material experiment operations.

Committee Comment

The Committee believes that the potential for the commercial application of microgravity science and applications research is very high although commercial profitability may not occur in the near term. Furthermore, the Committee agrees with the administration and NASA that the permanently manned space station should provide an environment conducive to advancing microgravity research and, in turn, to developing more completely the commercial applications of space. Therefore, the Committee is concerned that NASA and the administration are not committed to supporting the development of the strong research base necessary to bring about the commerical application of the results of microgravity scientific investigation.

The NASA request to support microgravity science and applications is evidence of the failure. The ongoing program has been dramatically reduced before the potential can be demonstrated. Accordingly, the Committee recommends an increase of $10 million for materials processing. These funds are to be used to continue the ongoing activities in the following areas: Biotechnology research and analysis, electronic materials, biotechnology flight equipment, fluid dynamics, combustion, glasses and ceramics, metals and alloys, multidisciplinary flight apparatus, and the development of levitation furnaces and furnaces with highly controlled thermal profiles. The Committee feels that development of this equipment will greatly enhance the commercial potential of the materials processing program. Furthermore, it is the intent of the Committee that this increase should be included in the base microgravity science and applications program from which NASA will develop future budget requests.

The Committee is pleased about the recent agreement between NASA and 3M to jointly undertake a long-range basic research program in space, with the aim of eventually producing commercial products in orbit. NASA is encouraged to seek and enter into additional agreements such as this to help bridge the Government/industry gap and to further our understanding of microgravity research and applications.

The Committee also is pleased with the program office's recent solicitation of proposals from interested universities to establish centers for organic separations and pharmaceutical research. The Committee feels these awards will do much to increase the degree of interest and research in the use of the microgravity (space) environment and act as an important educational tool.

COMMUNICATIONS—$65,600,000

The Committee authorizes $65,600,000 for fiscal year 1985 in lieu of the administration's request of $20,600,000.

Summary of funding levels, fiscal year 1985

Research and analysis	$9,100,000
Search and rescue	2,400,000
Technical consultation and support studies	2,900,000
Experiment coordination and operations support	1,200,000
Advanced Communications Technology Satellite	50,000,000
Total	65,600,000

Research and analysis

The communications research and analysis program provides the high-risk technology required to ensure continued U.S. preeminence in the field of satellite communication. In fiscal year 1984, the research and analysis program continues to support the development of component and device technology required by NASA, other Government agencies, and U.S. industry for advanced communications satellite systems. Research and analysis efforts are also directed toward defining the ground segment (that is, mobile and base station equipment) and networking technology for a first generation mobile communications satellite service. This is a joint study with industry and Canada to define a two-way radio, radio telephone and low-speed message and data service to mobile terminals operating in rural and nonmetropolitan areas. In November 1983, NASA signed an agreement with the Canadian Department of Communications to cooperate in the definition phase of the program. In fiscal year 1984, a notice of opportunity will be released to solicit U.S. industry participation.

Search and rescue

The search and rescue program is an international cooperative program that demonstrates the use of satellite technology to detect and locate aircraft or vessels in distress. The United States, Canada, France, and the Soviet Union developed the system, in which Norway, the United Kingdom, and Sweden also participate. Two COSPAS satellites and one search and rescue-equipped satellite (NOAA-E) are currently in operation. Over 120 lives have been saved in numerous incidents in Canada, the United States and Western Europe, and the list continues to grow on a weekly basis.

Technical consultation and support program

The technical consultation and support program will continue to provide for studies of radio interference, propagation, and special systems required for the growth of existing satellite services and the extension of new satellite applications. Support to the Department of State, the Federal Communications Commission, the National Telecommunications and Information Administration, and the Federal Emergency Management Agency in the development of frequency and orbit sharing techniques and strategies for upcoming World Administrative Radio Conferences (WAR's) will continue.

Experimental coordination and operations support program

The experimental coordination and operations support program assists other Federal agencies and public sector organizations in the development of experimental satellite communications for emergency, disaster and public service applications. The Application Technology Satellites (ATS) 1, 3, and 5 will continue operating until fiscal year 1985, at which time operations will be transferred to universities.

Advanced Communications Technology Satellite

The objective of NASA's Advanced Communications Technology Satellite (ACTS) flight-test program is to develop the high-risk advanced communications technologies which will apply to multiple frequency bands and will support a wide range of future communications systems for NASA, other Government agencies and industry.

The technologies to be tested in the ACTS 30/20 GHz (Ka) band frequency are (a) multiple fixed and scanning spot beams; (b) time division multiple access (TDMA) ground system architecture; (c) high speed digital baseband processing and intermediate frequency switching facilities; and (d) rain fade compensation methods.

The ACTS experimental satellite is designed to serve for 2 years and to advance the technologies critical to compete in the world market in the 1990's. ACTS is a joint Government-industry endeavor in which industry participants in the flight test program will include commercial communications carriers, who will submit proposals for experiments to be performed. When the proposals are approved, the experimenters will construct earth terminals at their expense and conduct the proposed experiments. The results of the experiments will be reported to NASA, where they will be compiled and published.

Fiscal year 1985 funding is required to continue ACTS technology development and activities leading to a flight-test program.

Committee Comments

For the past 2 years, the Committee has supported the Advanced Communications Technology Satellite (ACTS) program and its innovative Government/industry approach to experimenting with and testing advanced communications technologies. The Committee has felt all along that the goals established by NASA in concert with industry were in the national interest and were essential to maintaining U.S. preeminence in the world communications satellite industry.

Therefore, when the Committee learned that OMB had decided to significantly reduce the funding for ACTS and to descope ACTS from a flight test program to a ground test program based on a filing at the Federal Communications Commission (FCC) by Hughes Communications Galaxys Inc. In December 1983, the Committee was placed in the position of reexamining its previous position on the ACTS flight test program. The reexamination focused on (1) the urgency of advancing the technology, (2) the foreign competition in this area, and (3) the role of NASA in communications satellite research and development.

First, it is the Committee's belief that the market for communications satellites and their related systems and services are expanding and will continue to expand. A study performed by Western Union for NASA forecast a worldwide communications market worth $35 billion to $50 billion between 1981 and 2000. Quite clearly, if the U.S. communications satellite technology does not develop to meet this expanding market, Japanese and European competition will likely do so.

At present the United States is the dominant force in the world communications satellite industry. However, our foreign competitors are beginning to make noticeable inroads as a result of the lack of NASA research and development during the 1970's. The Japanese already have launched a communications satellite in the Ka band, the same frequency bandwidth the ACTS program and the recent Hughes Aircraft Co. proposal have targeted, and the Europeans and Japanese are making significant advances in the development and marketing of ground stations. Although the formal space budgets of the Japanese and the European Space Agency are less than that of NASA, the combined value of government and industry research and development spending in these countries reflects their commitment to penetrate the communications markets and to challenge the U.S. technological leadership.

As noted in a recent NASA publication entitled "ACTS—Advanced Communications Technology Satellite,": "The efforts by the Japanese and similar activities in Europe, particularly in the areas of spot-beam technology and Ka band advances, are serious threats to the U.S. lead in satellite technology, systems and market share. It has become clear that without appropriate Government support, the U.S. satellite lead will be lost, following the unfortunate precedent established in the consumer electronic industry".

It is the Committee opinion that the growing challenge of foreign competition warrants an aggressive governmental role in communications satellite research and development. The Committee does not want the errors of the 1970's repeated and continues to support NASA's research and development activities in the communications area.

Second, faced with the possibility that the NASA might simply ground test, rather than flight test, the ACTS technologies, the Committee has attempted to determine to what extent an ACTS ground test program would contribute to an appropriate level of technology development. The Committee believes that to give the planners and operators of future communications satellite systems the confidence needed to implement these technologies, a flight test program is required, not later than 1989. Once the private sector is aware of the risks associated with the technologies, it can make a more judicious, intelligent decision concerning the implementation of the technologies. This, in turn, should positively impact the U.S. position in the world communications satellite industry.

The Committee believes that the Hughes Aircraft Co. proposal is a responsive proposal for a perceived market in the 1980's; the ACTS technologies, however, are quite different and are designed to meet the needs of the 1990's, a time frame that is presently outside the scope of most private sectors firm's research and development activities.

The Committee feels that the fundamental question of NASA's role in communications satellite research and development once again has been reexamined in the course of this debate and the Committee comes to the same conclusions as did the Space Applications Board in 1977—NASA has a fundamental role in communications satellite technology development. Therefore, the Committee feels that an ACTS flight test program is an appropriate activity for NASA and the U.S. Government to support. As noted above, the once unchallenge U.S. leadership in the communications satellite industry is now being seriously and, quite often, successfully, challenged and the technology gap is narrowing. Recognizing that almost half a year has been lost in this debate, the Committee authorizes an additional $45 million for the Advanced Communications Technology Satellite program for fiscal year 1985. The Committee realizes that this commitment carries with it an implied budgetary obligation for the next several years. However, under the circumstances, the Committee believes that this is an obligation that the Nation cannot afford to ignore. To preclude any further disruptions in the ACTS program, the Committee's bill requires NASA to enter into and finalize, as expeditiously as possible, a contract with the contractor team with which NASA had been negotiating prior to the interruption of these negotiations. This provision in the bill is designed to reduce the possibility of additional delays in the activities leading to a flight test in 1989.

INFORMATION SYSTEMS—$16,200,000

The Committee authorization for fiscal year 1985 is $16,200,000, which is identical to the administration request.

The objectives of the information systems programs are to: Develop and demonstrate advanced capabilities for managing, distributing, and processing data and information; implement information systems standards and provide transportable common software in order to lower data systems costs; and develop the basis for data services to provide improved access to, and rapid delivery of, space data and advanced data systems in support of the Nation's satellite programs and the space science and applications projects.

This program provides for timely development of data systems capabilities to meet the needs of flight missions and major space science and applications programs. The early demonstration of capabilities has a high potential for reducing ground data systems development risks and the chance of late data delivery.

TECHNOLOGY UTILIZATION—$9,500,000

The Committee authorizes $9,500,000 for fiscal year 1985 for technology utilization, which is identical to the administration's request.

The NASA technology utilization program is designed to enhance national economic growth and productivity through the transfer of new technology resulting from NASA research and development programs to the nonaerospace sectors of the economy. In addition to generating use of aerospace technology in U.S. industry, such technological advances have found use in important public sector areas such as medicine, transportation, environment and public safety. The specific objectives of the program are to accelerate and facilitate the application and use of new technology thus shortening the time between development of advanced aeronautics and space technologies and their full use in the economy; to encourage multiple secondary uses of NASA technology in industry, education, and Government where a wide spectrum of technological problems and needs exists; to understand more fully the technology transfer process and its impact on the economy, and to manage and optimize the process in a systematic way; and to develop applications of NASA's aerospace expertise—its technology, technologists and unique facilities—to nonaerospace needs of the Nation.

Committee comment

Consistent with the position that the Committee has taken on NASA's materials processing in space program and with the Committee's initiative in space commercialization, the Committee endorses the activities of NASA's technology utilization program as another resource with which NASA can help develop closer cooperation between Government and industry. The Committee encourages NASA to emphasize its industrial application centers and its other dissemination centers as conduits through which the flow of technology will benefit not only our existing industrial base but also the embryonic space commercialization industry.

SPACE COMMERCIALIZATION—$5,000,000

Committee comment

Over the past two decades, significant payoffs (both private and public) have been demonstrated in several space venture areas including communication satellites, meteorology satellites, Earth resources satellites, and, more recently, space manufacturing. With the Space Shuttle offering routine and reliable access to space and with other facilities for ground-based testing and on-orbit research, the Committee believes that the circumstances are appropriate for encouraging new private sector participation and investment in commercial space activities.

In his State of the Union Address on January 25, 1984, President Reagan outlined a comprehensive plan for space which included an appeal for a Government-industry partnership to ensure expanded private sector investment and involvement in the commercial development of space. The Committee supports the President's space initiative, including his plans for a permanently manned space station and feels that a Government-industry partnership will maximize the benefits from the development of space.

Many other recent developments have reflected a growing interest in the potential of commercial space activities. During the last half of 1983, NASA sponsored, within the agency, a Space Commercialization Task Force to define potential commercialization initiatives and to develop management plans for implementing an agencywide commercialization policy. Outside the agency, a broad group of industry representatives have been working with the White House to determine how the Government can best encourage and facilitate the use of space and space technology by both aerospace and nonaerospace firms. The desirability of commercial space activities has also been studied by a number of prestigious non-Government groups. In its recent report entitled, "Encouraging Business Ventures in Space Technologies", the National Academy of Public Administration emphasized the importance of private sector involvement:

> The extent to which past investment in space technology contributes to our future economic well-being and national growth will depend in large measure on policies and actions taken in a spirit of collaboration by the Federal Government and industry. Unless the public and private sector join to develop the opportunities presented by new space technologies and unless entrepreneurial forces are engaged more fully, the United States will fall behind in the contest for leadership in space and the economic rewards associated with that position.

The Committee recognizes that, over the years, the aerospace industry has developed the scientific and technological capabilities necessary to pursue space commercialization. However, for many nonaerospace firms, there is an intrinsic reluctance to enter this exotic arena. As intrigued as they may be by potential payoffs, private investors are still wary because of a general lack of understanding of what types of commercial space opportunities actually exist. Also, investors are cautious of becoming involved in projects that depend on a rate of return over a long period of time when little tangible evidence exists of a stable and durable Government commitment to support such risk-prone ventures.

Private sector investment is based upon the estimation of profitability and predictability. These factors can become more concrete with a strong, visible Government commitment to help lead the way through these "unchartered waters". NASA's Space Commercialization Task Force has worked to determine the most appropriate role for NASA and the Federal Government in encouraging and facilitating space commercialization. As a follow-up to the work of the Task Force, NASA is developing plans to establish within the agency a high-level Office of Space Commercialization to serve as the focal point for private sector firms that are interested in commercial space activities. The Committee has reviewed these plans and supports the expeditious creation of an Office of Space Commercialization.

A major concern of potential private sector investors has been the absence within NASA of a focal point which could facilitate access to the NASA organization and those resources that are essential to stimulating commercial space investment. In anticipation of the establishment of such an office, the Committee authorizes $5 million for space commercialization activities in fiscal year 1985.

The Committee also invites NASA to target new high tech commercial space ventures and new commercial space applications of existing technologies. Many of the potential participants in these areas lack the longstanding involvement that is necessary to confidently pursue these activities and Government support is critical to the initial entry of these participants into these areas.

Furthermore, the Committee urges NASA to consider, as elements within the overall space commercialization initiative, the following activities:

1. The initiation of several National Centers of Excellence to encourage partnerships among industry, academia and Government to perform research in areas with a high potential payoff;
2. Prioritized research by NASA in selected areas where early research and development results can be expected to foster commercial space endeavors;
3. The use of independent intermediaries with strong business community ties and credentials to identify and stimulate a much broader cross-section of potentially interested American businesses;
4. Identification of NASA facilities and equipment available for increased private sector use in ground tests and flight experimentation; and
5. Provision of exploratory commercialization seed funding to help entrepreneurial technologists.

The Committee is encouraged by the agreements that NASA has established with private sector firms such as John Deere, McDonnell Douglas, Ortho Pharmaceuticals, Microgravity Research Associates, Fairchild Industries, and 3M, and is hopeful that this fiscal year 1985 authorization will play a key role in fostering new agreements with other aerospace and nonaerospace firms.

The Committee recognizes that long-term, high-risk research and development does not always produce near-term profits, and, therefore, realizes that the commercial payoffs of a government initiative in space commercialization may not be immediate. But, as distant as the long-term payoffs may be, they may never exist unless a foundation is established. By authorizing a modest investment of $5 million, the Committee hopes to lay the groundwork that is necessary for the success of this initiative. Furthermore, the Committee hopes this authorization sends a signal to industry that the government is indeed committed to space commercialization. The Committee believes that space commercialization is in the national interest and deserves a vigorous, aggressive advocacy within the Federal Government. Our Nation must be equipped to exploit space for the benefit of the United States and the world.

Aeronautical Research and Technology—$357,400,000

The Committee authorizes $357,000,000 for fiscal year 1985, $10 million above the administration request, to be allocated as follows:

Research and technology base	$233,300,000
Systems technology base	124,100,000
Rotorcraft systems technology	(26,500)
High-performance aircraft systems technology	(21,000)
Subsonic aircraft systems technology	(19,000)
Advanced propulsion systems technology	(31,100)
Numerical aerodynamic simulation	(26,500)
Total	357,400,000

The objectives of the aeronautics program are to advance aeronautical technology to insure safer, more economical, efficient, and environmentally acceptable air transportation systems which are responsive to current and projected national needs; to support the Department of Defense in maintaining the superiority of the Nation's military aircraft; and to maintain the strong competitive position of the United States in the international aviation marketplace.

The research and technology base program will build on the substantial results of the ongoing program, utilizing the unique NASA experimental facilities, research aircraft, computer capabilities, and expertise now in existence. Fundamental discipline efforts will continue to lead to significant test techniques and the development of computational methods to better understand and predict aerodynamic and thermodynamic characteristics associated with complex flows over aircraft and in propulsion systems to improve performance and reduce development costs; metallic, ceramic, polymer, and composite materials for high temperature engine applications and lighweight airframe structures; the development of analytical methods to improve life prediction and better understand and control the dynamic response of complex aircraft and engine structures; electronics and highly reliable, fault-tolerant aircraft control system software and architectural concepts; crew station technology and the capability of modeling pilot behavior in a multivariable environment; and a better fundamental understanding of alternative fuels and their potential impact on engine performance. The discipline and vehicle oriented research and technology base efforts in the various speed regimes will continue with wind-tunnel investigations on advanced aircraft and rotorcraft configurations, and examinations of the effects of promising technology advances individually and in combination.

The systems technology programs are designed to accomplish the following objectives: To extend the scientific discoveries and findings flowing from the research and technology base through applied research to demonstration and validation for selective technologies which thereafter provide the design base for advanced military and commercial products undertaken by private industry.

Rotorcraft systems technology

The rotorcraft systems technology program conducts research on two fronts. The first thrust consists of efforts in broad systems technology areas that advance the state of the art in flight dynamics and controls, aerodynamic analyses, and the prediction and reduction of loads, vibration and noise. The second thrust involves advanced military and civil concepts which are investigated in conjunction with DOD and the Federal Aviation Administration. These currently include the X-Wing demonstration test on the Rotor Systems Research Aircraft (RSRA), and XV-15 tilt flight testing. In both of these thrusts, integrated system testing is required and involves large-scale wind tunnel testing, flight testing and moving-base simulation.

With the delay of 40x80x120-foot wind tunnel operation until fiscal year 1986, a large backlog of tests will accumulate. The interactional aerodynamics test which seeks to examine main rotor/fuselage/tail rotor/wing interference and noise and loads measurements will continue in the preparation stage. Also undergoing preparation will be the test of multicyclic control for vibration suppression to investigate various control algorithms in order to document the promise of adaptive control theories for the first time. Arrangements for the French rotor test and a reconstructed bearingless main rotor to be tested in 1986 will continue. A UH-60 rotor will be instrumented for comprehensive noise testing in 1986.

The advanced technology tilt rotor blades will be tested on the XV-15. This will conclude the NASA flight test program of this very successful research aircraft. One vehicle may go to the Navy in support of the JVX full-scale development. A JVX rotor/wing combination will be tested in the 40x80-foot wind tunnel as a critical milestone in that program. It will be the first test in that facility when it becomes operational in fiscal year 1986. Simulation support will also continue.

The X-Wing rotor program will be generating wind tunnel, simulation, and analytical data. This fast-paced program culminates in several crucial tests in 1985 and will require special NASA capabilities to support the contractor's efforts. In particular, a model rotor test will be supported for detailed aeroelastic behavior in helicopter transition, conversion, and stopped rotor flight modes. The first demonstration flight of the X-Wing rotor concept is expected in 1985.

High performance aircraft systems technology

The objective of the high-performance aircraft systems technology program is to generate validated engineering methods and design data applicable to the development of advanced high-performance, high-speed aircraft for military and civil applications. The program objective is accomplished by analysis, ground-based simulations, and wind tunnel experimental research and flight research tests of aircraft, as well as development of specific analytical methods for turbine engine durability improvements.

The fiscal year 1985 funding level reflects an increased emphasis on high-performance flight research to provide the technology foundation applicable to the development of future high-performance aircraft. The high-performance flight research activity in fiscal year 1985 will involve a variety of high-performance aircraft to investigate advanced concepts. Several projects will continue their flight test phases during this period. Under the joint NASA/Air Force advanced fighter technology integration (AFTI) projects, the F-16 aircraft will continue flight evaluation of integrated technologies comprising the automatic maneuvering and attack system (AMAS), and the F-111 mission adaptive wing will continue flight envelope expansion starting with the preliminary assessment of the automatic flight control system (AFCS). The joint NASA Defense Advanced Research Projects Agency (DARPA) X-29A forward swept wing flight demonstration program will continue its envelope expansion and begin its flight research phase of the program. The F-15 highly integrated digital electronic controls (HIDEC) program will begin flight research to evaluate the potential of improving the performance and mission effectiveness due to engine-airframe control integration. The high angle-of-attack flight research activity will be continued using other aircraft opportunities and will focus on developing the design methodology applicable to handling qualities improvement and control system design for aircraft operation at high angles of attack. In fiscal year 1985, the YAV-8B Harrier program will concentrate on evaluation of the performance of the NASA-modified flight control system for comparison with simulations.

In fiscal year 1985, the hot section technology (HOST) program will concentrate on continued improvements in instrumentation to validate newly developed models; studies on multiple jet dilution mixing and flame radiation/heat flux modeling; and 3-D flow and heat transfer models for nonrotating and rotating components, including cooling passage effect. Advanced 3-D inelastic structural/stress analysis methods and solution strategies will be developed, along with anisotropic life/constitutive models for creepfatigue interaction. Also, the role of oxide scale and coating composition in hot corrosion will be evaluated. The research program on the use of ceramic materials for long-life components will continue.

Subsonic aircraft systems technology

The objective of the subsonic aircraft systems technology program is to provide a substantiated base of key technologies, design data and validated design procedures. Individual concepts are examined in the systems context with other interacting components and technologies to define techniques and procedures for obtaining maximum benefit from these applications. To this end, the advanced composite structures technology program is designed to develop a composite primary airframe structures technology base that achieves the full potential of weight, fuel, and cost savings possible for the design of civil and military transport aircraft in the 1990's. The program's purpose is to establish a composite engineering data base which will permit Government and industry management decisions to commit composities to advanced, large aircraft with acceptable cost and risk. Full airframe use of lighter weight composities in primary airframe structure can reduce overall aircraft weight and acquisition costs by up to 15 percent, significantly lowering operational costs and extending service usage.

Advanced propulsion systems technology

The objective of the advanced propulsion systems technology program is to explore advanced concepts for future aircraft engines in high-payoff technology areas through the focusing of fundamental research and technology efforts and integration of advanced propulsion components.

The energy efficient engine program is nearly complete. The integrated core/low spool test has been completed successfully and the remaining component tests, which are compressor rig tests at both contractors, will be completed during 1984. All data support the goal of 15 percent fuel savings when these technologies are applied to advanced turbofan engines. Studies conducted during fiscal year 1983 have shown that advanced component technologies beyond those developed in the energy efficient engine program have the potential to reduce fuel consumption an additional 15 percent.

Activities in the advanced turboprop systems program are focused on development of a broad research and technology data base and on support for potential future systems integration/flight research phase necessary to establish large-scale advanced turboprop feasibility. The preliminary design review for the large-scale advanced propeller (LAP), 9-foot-diameter SR-7, was conducted. The design recommended by Hamilton Standard was approved, and fabrication of the first large-scale single-rotation blade will be performed in 1984. An independent assessment of the SR-7 aerodynamic, acoustic, structural and aeroelastic characteristics is in progress at Lewis Research Center (LeRC). Detailed design of the 2-foot-diameter aeroelastic model of the SR-7 is underway and will be used to verify the aeroelastic scalability of the 9-foot LAP. The proposals for the propeller test assessment (PTA) are being evaluated, with contract award scheduled for 1984. A contract was awarded on November 22, 1983 (to the General Electric Co. to provide a counter-rotating propeller drive rig and several 2-foot-diameter propfan models to the Lewis Research Center for testing in the 8 x 6 foot wind tunnel. A proposal for an unducted fan engine ground test program for a gearless counter-rotation propfan concept is also in the evaluation process of LeRC with a contract award scheduled for 1984. High-speed wind tunnel aerodynamic performance investigations of the contoured over-the-wing nacelle installation on a semispan wing and low-speed wind tunnel stability and control investigation of aft-mounted configurations will continue in 1984. Subscale propeller model tests in high-speed wind tunnels and on the Jet Star aircraft have given encouraging indications of achieving cabin comfort and community noise goals with only minimal weight and configuration penalties.

In fiscal year 1985, advanced turboprop systems program activities will continue to develop the broad-based supporting technology required for advanced high-speed turboprop propulsion and will include advanced concepts and configurations such as counter-rotation propeller systems. In fiscal year 1985, the aeroelastic model of the large-scale propeller (SR-7A) will be fabricated, and wind tunnel aerodynamic performance investigations of improved under-the-wing and over-the-wing nacelle installations on improved semispan wings will be completed. High-speed wind tunnel stability and control investigations of wind and aft-fuselage mounted propeller configurations will be completed. High-speed investigations of wing- and aft-mounted counter rotation propeller configurations will also be carried out. Additionally, validation tests of counter-rotation propeller model performance and acoutics will be completed.

Numerical aerodynamic simulation

The numerical aerodynamic simulation (NAS) program objective is to significantly augment the Nation's capabilities in computational fluid dynamics and other areas of computational physics by developing a preeminent capability for numerical simulation of aerodynamic flows. This program will provide the computational capabilities required to obtain solutions to problems which are currently intractable.

The first high-speed processor for the NAS system will be acquired in 1984 and will continue under lease through fiscal year 1985 and beyond. This high-speed processor is the heart of the NAS system and the key component around which the extensive, user friendly subsystems are assembled. The development of the system control and operation software will be continued during fiscal year 1985 leading toward an fiscal year 1986 initial operational status for the NAS system. The NAS system network development will continue with the acquisition of critical system components required to attain system operational status. The critical system components include additional work stations to provide access to the NAS system through the support processing subsystem and acquisition of components for the long-haul communications subsystem which will allow remote access to the NAS. Additionally, initial acquisition and assembly of the graphics subsystem will occur, which is required to support the output and analysis of large data-producing solution/simulations. The combination of the work station, support processing, and graphics subsystems is critical to the successful initial operation of the NAS system. System tests and integration activities leading up to the initial NAS operations will begin in fiscal year 1985. These tests and integration activities are necessary to assure that the NAS system meets the system requirements developed during the initial planning activities. Fiscal year 1985 will be a year of intense activities leading toward the initial operations of the NAS system in fiscal year 1985.

Committee Comment

The Committee commends the administration for the significant increase in funding above that for fiscal year 1984 for aeronautical research and technology, particularly in light of the funding requested by the administration in previous years. However, as in prior years, the administration has failed to recognize the importance of the advanced turboprop technology program to the future of the U.S. aviation industry. In years past, this technology program has been one of the Committee's highest priorities, and the Committee has annually been forced to augment the funding for the advanced turboprop to accommodate the annual shortfall in the administration's budget request.

The Committee continues to believe that NASA, in cooperation with industry, should proceed with the development of the advanced turboprop propulsion system, with the ultimate goal of a flight test by 1987 to prove this critical technology. To this end, the Committee authorizes an additional $15 million to advanced propulsion systems technology for activities leading to a 1987 flight test of either a single-rotational or counter-rotational turboprop concept and supporting research and technology. The Committee feels that in proceeding with its research and development work in this area, NASA should explore both single and counter-rotational concepts thoroughly. The ultimate goal is the continued U.S. preeminence in civil aviation, and the Committee believes that no individual concept should be precluded from consideration for the 1987 flight test until a broader base of knowledge has been developed.

The Committee recognizes the potential benefits that could accrue to the United States from a major initiative in ceramics for advanced heat engines; however, the cost, risk and reliability are still the major constraints that have prevented U.S. private industry from making the necessary effort to advance this technology. Meanwhile, foreign competition may be overtaking U.S. technology in this area. The Committee feels the high-risk, long-term nature of this technology development represents an appropriate role for governmental research and development. Therefore, within the aeronautical research and technology base programs, the Committee recommend that NASA reprogram not less than $2 million toward ceramics for gas turbine engines.

SPACE RESEARCH AND TECHNOLOGY—$150,000,000

The Committee authorizes $150 million for space research and technology, as requested by the administration.

Summary of funding levels for fiscal year 1985

Research and Technology base	$136,000,000
Systems Technology programs	9,100,000
Standards and Practices	4,900,000
Total	150,000,000

The overall goal of the space research and technology program is to advance the technology base in support of NASA's role as an effective, productive, and long-term contributor to the continued preeminence of the United States in space. The specific objectives of this program are to support a broad-based advance technology program designed to provide new concepts, materials, components, devices, software and subsystems for use in U.S. civil and military space activities; assure preeminent national capability through extensive and interrelated participation in the program by the NASA centers, other Government agencies, universities, and industrial research and technology organizations; and maintain NASA centers in positions of recognized excellence in critical space technologies. The fiscal year 1985 program supports these objectives by placing emphasis on disciplinary technologies that provide the necessary data base and understanding to create new opportunities for future national civil, military, and commercial space mission objectives, and on systems technology program directed at obtaining fundamental data from in-space experimentation, and transferring advanced technology into space programs through more focused efforts that provide proof of concept to support technology readiness for anticipated applications.

TRACKING AND DATA ADVANCED SYSTEMS—$15,300,000

The Committee authorizes $15,300,000 for the tracking and data advanced systems budget, as requested by the administration.

Summary of funding levels, fiscal year 1985

Advanced systems	$15,300,000

The overall objective of the advance systems program is to perform studies and provide for the development of tracking and data systems and techniques required to: (1) obtain new and improved tracking and data capabilities that will meet the needs of approved new missions and near term new starts; and (2) improve the cost effectiveness and reliability needed for overal support of the total mix of spaceflight missions.

This program remains a vital element in the space tracking and data systems program. Activity continues under this program to assess the dramatic changes taking place in the state-of-the-art in telecommunications and computer technology. Such effort is critical for proper planning and for the application of new technology to future support capabilities that are cost effective and reliable. Efforts include the investigation of upcoming missions and studies of ground systems and telecommunications links to determine design approaches and overall trade-offs for the lowest life-cycle costs to support future space missions.

SPACE FLIGHT, CONTROL, AND DATA COMMUNICATION—$3,585,300,000

SHUTTLE PRODUCTION AND OPERATIONAL CAPABILITY—$1,470,600,000

The Committee authorizes $1,470,600,000 for fiscal year 1985, $5 million more than the administration's request.

Summary of funding levels, fiscal year 1985

Orbiter	$651,800,000
Launch and mission support	219,800,000
Propulsion systems	599,000,000
Changes and system upgrading	
Total	1,470,600,000

The Space Shuttle is the key element of a versatile space transportation system (STS) that is available to a wide variety of national and international users. The Space Shuttle is the first reusable space vehicle and is configured to carry many different types of space applications, scientific, and national security payloads. The Space Shuttle offers unique capabilities that cannot be achieved with today's expendable launch vehicles—to retrieve payloads from orbit for reuse; to service and repair satellites in space; to transport to orbit, operate, and return space laboratories; to transport materials and equipment to orbit; and to perform rescue missions.

Shuttle production and operational capability development provides for the national fleet of Space Shuttle orbiters, including main engines, and provides for the launch site and mission operations control requirements, spares, production, tooling, and related supporting activities to meet appropriate national needs. More specifically, this line item contains the orbiter production for three flight orbiters; and initial modification of Columbia (OV-102) for Spacelab with a subsequent major modification to effect its changeover into its operational configuration; the procurement of major structural orbiter components to be used as spares for the fleet; the residual development tasks for the orbiter, main engine, external tank (ET) and solid rocket booster (SRB); Johnson Space Center (JSC) mission support capability development; the provision of the second line of processing stations and equipment for launch and landing at the Kennedy Space Center (KSC); the development of the filament would case (FWC) solid rocket booster; the lay-in of spares and the ground support equipment; and the production rate tooling for the ET and SRB. Modifications to two orbitors, mobile launch platforms (MLP), and launch pads for the 1986 launches of the Centaur as a space transportation system upper stage are also funded under this budget item.

The continuation of the orbiter production has been a major activity during the past year. Discovery (OV-103) was delivered in November 1983 and brings to three the number of orbiters now available for flight. Columbia (OV-102) and Challenger (OV-099) were previously delivered and have flown several flights each. Atlantis (OV-104) also continues its production progress and is now into the mate and final assembly phase at the Palmdale contractor facility. However, the date of delivery of Atlantis has slipped from December 1984 to April 1985. Support of the flight program also has been a major activity of the orbiter program. OV-102 was modified at KSC in order for the vehicle to support the recently completed Spacelab mission. A final period of OV-102 modifications will take place in the January 1985 to August 1985 time frame to place the vehicle in its fully operational configuration.

At KSC, the second line of vehicle processing stations is being phased in to support the parallel launch processing of orbiters. Parallel processing can be done in the orbiter processing facility (OPF) and vehicle assembly building (VAB) since activation in fiscal year 1982 of the second OPF high bay and second MLP and in fiscal year 1983 of the software production facility, the second launch control room, and the second set of VAB high bays. Parallel processing at the launch pad will be possible after Pad B completion January 1, 1986, consitent with the requirements to support the Centaur launches of Galileo and International Solar Polar Mission (ISPM) in May 1986. The third MLP is planned for a September 1986 operational readiness date.

Initial certification of the Space Shuttle main engine (SSME) in a full power level (FPL) configuration was completed. The FPL capability is necessary to allow NASA's payload commitments to be met. The successful completion of the FPL certification then allows flight operations at the 109 percent thrust level. However, during the course of FPL certification testing, it became apparent that the current SSME configuration requires an unacceptably high level of maintenance. In addition, a detailed review and assessment of the SSME program (prompted by the pre-flight delays of STA-6) revealed that there is an inadequate logistics base of engines and spare parts to ensure an uninterrupted operational program. As a result of the FPL certification test experience and the SSME review, the SSME program has been replanned so as to focus on solutions to the excessive maintenance problem and the inadequate logistics base. A two-phase effort is directed at significantly improving the life of the high pressure turbopumps; four additional engines have been added to the production schedule; and the production and engine overhaul schedules have been accelerated. During this year, five flights of the Space Shuttle were completed (STS-9) with no SSME anomalies which impacted launch performance. Thus the concept of a high thrust, reusable rocket engine continues to be viable.

NASA has just initiated a significantly expanded development program to improve the operational reliability and cost-effectiveness of the SSME. The near-term objectives are to fine-tune the current turbopump designs to improve durability. The long-term objectives are based on a recompetition of the SSME contract and are grounded in four separate procurement actions. The first of these actions was the release on March 2, 1984 of a request for proposal for engine system and component level improvements, primarily in the powerhead and turbopumps. The second action will solicit proposals for improvement in piece parts that feed the component and engine building process. The third action will involve solicitation of bids for build-to-print manufacturing operations to develop alternate supply resources for critical components. The fourth is for a conceptual feasibility study of a national rocket engine development complex.

The experience with the SRB's during earlier flights indicated the need for design improvements to reduce the amount of water impact damage to the SRB aft skirt, and to the hydraulic power units mounted internally to the aft skirt. Design improvements have been incorporated subsequent to the loss of the STS-4 boosters and have proven to be successful in reducing structural damage. Problems still exist with water intrusion and damage to the thrust vector control (TVC) hydraulic power units. Development activity has been initiated for design changes to the TVC system to eliminate this problem. In order to reduce the water impact velocity, which is the major contributor to the damage at water impact, the use of larger main parachutes is also being explored.

The first high performance motor was successfully flown on STS-8. The performance characteristics of the motor were normal and well within specifications. Post-flight inspection of the motor indicated some minor changes are required in the manufacturing process for the carbon phenolic nozzle material. Efforts are underway to correct this problem.

Performance of the ET on all nine Shuttle flights has been excellent. All flight hardware has been delivered on or ahead of schedule. Weight savings on the lightweight tanks have been greater than baselined and should continue to be realized as additional planned improvements are implemented. Cost reduction/producibility/production readiness efforts continue to be a high priority, as additional tooling and equipment is introduced to meet production requirements of 24 tanks per year. Significant improvements have been realized in the reduction of ablation on the tank and associated labor and tooling.

The development of the FWC for the SRB's to improve the payload capability of the Space Shuttle for high performance missions has been progressing toward achieving major program milestones. During the past year, design allowables were established; manufacturing processes and tooling were verified and six full diameter segments were manufactured (3 12-foot length and 3 full-length). Hydro-burst tests were performed on a full-diameter segment as well as combined segment/joint hydrotest. Major emphasis has been placed on technical areas related to the composite FWC development by the formation of an expert working group from within NASA and contractors organizations to address materials/processes, nondestructive evaluation, and fracture machanics.

Committee comment

Although it is not completely clear if a five-orbiter fleet is necessary to meet the future space transportation system requirements that can be forecast now, the Committee continues to believe, as it has in past years, that a Shuttle fleet or five orbiters is economically prudent and in the national interest. The cost reductions associated with Shuttle flights can only be realized through a higher flight rate which, in turn, can only occur with a sufficient fleet or orbiters.

The Shuttle is just beginning to demonstrate some of its multifaceted capabilities, and requirements for the Shuttle are likely to increase as we begin to increase and diversify our space activities. Only by increasing the launch rate and fully utilizing the unique on-orbit and return capabilities of the Shuttle can the Nation fully realize the intended benefits of the STS and recover the substantial public investment which has been made.

Even if one disregards an optimistic expectation of the future Shuttle manifest, one cannot overlook the distinct possibility that an attrition vehicle may be needed to maintain even the most conservative expectations of Shuttle requirements. Our experience to date indicates that, even after moving into an operational mode, anomalies may continue to occur. Once a flight rate of 24 launches per year is reached, an anomaly that may remove an orbiter from service for even 2 to 3 months could noticeably disrupt the flight schedule. With the Shuttle pricing policy moving to a full cost recovery by fiscal year 1988, the STS must demonstrate, above all else, reliability and dependability.

For these reasons, the Committee has authorized an additional $45 million for orbiter production within Space Shuttle production and operational capability to augment structural spares and to maintain the critical skills necessary for production readiness for a fifth orbiter.

During its fiscal year 1985 authorization hearings, the Committee received testimony from the agency concerning the amount by which the cost of a fifth orbiter would increase each year the fifth orbiter decision is delayed. Based on this testimony, the Committee believes that, for economic reasons, a decision to procure a fifth orbiter should be made within the next 2 years; otherwise, exorbitantly unnecessary costs could be added to the ultimate cost. Therefore, the Committee requests NASA to submit no later than October 1, 1984, a study which assesses the agency's consideration in making this decision, along with the perceived ramifications of making a decision not to purchase a fifth orbiter.

The Committee realizes that the recent Air Force decision to purchase and launch a minimum of two commercial expendable launch vehicles per year for 5 years, beginning in fiscal year 1988, could negatively impact the STS. However, the Air Force requirement for assured access to space is a responsible requirement. The Committee requests NASA to factor this decision into the study requested above and to comment on the implications of this decision on the future of the STS.

The Committee continues to maintain an interest in the concept of an extended duration orbiter (EDO) as another means of achieving a longer manned presence in space and as a possible test-bed toward achieving a permanent manned presence in space. It appears that modifying an orbiter to achieve a 21-day on-orbit capability can be accomplished for a relatively modest cost. However, there are questions that still deserve answers. Do the benefits of a 21-day on-orbit capability justify the costs, modest as they may be? To what extent might the orbiter fleet be compromised by these modifications and to what extent would extending the on-orbit capability of an orbiter affect the Shuttle manifest? What would be the utility of an EDO once a permanently manned presence is achieved?

The Committee endorses the study that the House Science and Technology Committee has requested on the EDO concept and hopes that this study resolves these and other related issues.

With regard to Shuttle safety, the Committee notes that in 1983 NASA experienced several problems with the auxiliary power unit system and the landing gear system. For the past 2 years, NASA's Aerospace Safety Advisory Panel (ASAP) has expressed concern about the safety of both of these systems. The Committee requests a report from NASA by September 1, 1984 on (1) what action, if any, the agency took concerning these two systems subsequent to the release of the January 1983 ASAP report, and (2) the agency's planned response to the recent problems that have beset these two systems.

The Committee has recommended a $15 million reduction in funding for launch and mission support, which can be accommodated by the deferral of less critical activities. The Committee believes that the resulting authorization of $219,800,000 is adequate for the agency to continue its activities of mission preparation, mission operations, launch and recovery operations, and astronaut crew training.

A reduction of $25 million in changes and systems upgrading is also recommended by the Committee. With the delivery of the orbiter Atlantis in April 1985, activities related to the development of the Shuttle may be deemphasized without any degradation of the capabilities of the STS.

SPACE TRANSPORTATION OPERATIONS—$1,319,000,000

The Committee authorizes $1,319.0 million for fiscal year 1985, $20.0 million less than the Administration request.

Summary of funding levels, fiscal year 1985

Shuttle operations (flight operations, flight hardware, and launch and landing operations)	$1,319,000,000

Space transportation operations provides the standard operations support services for both of the primary U.S. space launch systems: The Space Shuttle and the expendable launch vehicles. Within Shuttle operations, external tank and solid rocket booster flight hardware is produced; operational spare hardware is provisioned, overhauled and repaired; and the manpower, propellants, and other materials are furnished to conduct and support both flight and ground (launch and landing) operations. The Space Shuttle operations program provides for the launch of NASA, DOD, other U.S. Government, domestic commercial and international missions. The 1984–87 launch schedule calls for 6 flights in fiscal year 1984 and 10 flights in fiscal year 1985. The flight-rate in later years is planned to accommodate 24 launches per year by 1988–89. The first Vandenberg launch is scheduled for early fiscal year 1986.

The Space Shuttle provides for launch services to non-NASA users on a reimbursable basis; the amount paid by users is tied to the size of the user's payload and the services required to support the user's launch requirements. For flights through fiscal year 1985, the computation is based on a full mission cost for standard launch of $18 million per flight in 1975 dollars; for fiscal year 1986–88 flights, the charge will increase to $38 million in 1975 dollars. The budget is based on charging DOD $16 million in 1975 dollars for dedicated flights in fiscal year 1984 and fiscal year 1985, and $29.8 million in 1975 dollars for flights during fiscal year 1986–88. The Bureau of Labor Statistics computation of compensation per hour is used as the index for escalating 1975 dollars to current dollars for billing purposes. The projected receipts from reimbursable users are applied against total program funding requirements to derive the amount of appropriated funds requested.

The Shuttle operations budget request funds three principal areas: Flight operations, flight hardware, and launch and landing operations. Under flight operations is mission support, integration, and support; the flight hardware program provides for the procurement of the external tanks (ET), solid rocket motors, booster hardware, and propellants; spare components for the SSME's; orbiter spares; sustaining engineering and logistics support for external tank/solid rocket booster/main engine flight hardware elements; and maintenance and operation of flight crew equipment; and launch and landing operations provides for the launch and landing operations of the Space Shuttle and its cargo.

At KSC, four operational missions were processed and launched successfully during fiscal year 1983, including the first Spacelab processing and launch. KSC plans to launch an additional seven missions in fiscal year 1984. Initially, five of these launches were scheduled to land at the KSC Shuttle landing facility. However, this policy appears less certain now, due to technological difficulties in predicting weather patterns at KSC. The landing of the orbiter Discovery from its maiden voyage in June 1984 has been changed from KSC to Edwards Air Force Base, Calif. KSC has completed the first full year with the base operations contractor and recently awarded the Shuttle processing contract which established one consolidated contractor for Shuttle launch and landing activities both at KSC and Vandenberg. Preliminary plans are also underway to propose consolidation of the cargo processing effort in the fiscal year 1986 timeframe.

The contracting philosophy for the operations component of space transportation has been directed toward the consolidation of contracts to strengthen the STS launch function. To this end, a base operations contract (BOC) was awarded in early fiscal year 1983 to establish a single on-site, consolidated support contractor to provide institutional support to the KSC organizations. The Shuttle processing contract (SPC) was awarded in late fiscal year 1983 establishing one consolidated contractor for launch and landing activities and operation of related ground systems at both KSC and Vandenberg. There are plans to incorporate a consolidated cargo processing contract (CPC).

Committee comment

As the Shuttle flight rate continues to increase and as the turnaround time continues to improve, the Committee expects Shuttle operations to become more efficient than has been estimated. For this reason, the Committee recommends a reduction of $20 million in Shuttle operations. The resulting authorization of $1,319,000,000 million should adequately support the Shuttle flight schedule for fiscal year 1985 without any degradation in STS safety or reliability.

SPACE AND GROUND NETWORK, COMMUNICATIONS AND DATA SYSTEMS—$795,700,000

The Committee authorizes the budget request of $795,700,000 for space and ground network, communications and data systems.

Summary of funding levels, fiscal year 1985

Space Network	$386,500,000
Ground Network	223,600,000
Communications and Data Systems	185,600,000
Total	795,700,000

The purpose of this program is to provide vital tracking, command, telemetry, and data acquisition support to meet the requirements of all NASA flight projects. In addition to NASA flight projects, support is provided for projects of DOD, and on a reimbursable basis to other Government agencies, commercial firms, and other countries and international organizations engaged in space research endeavors.

Support is provided for sounding rockets, research aircraft, Earth orbital and planetary missions, and deep space probes. The program also includes the support of the Space Shuttle and Spacelab flight program. The various types of support provided include: (a) tracking to determine the position and trajectory of vehicles in space; (b) acquisition of scientific and space applications data from on-board experiments and sensors; (c) acquisition of engineering data on the performance of spacecraft and launch vehicle systems; (d) transmission of commands from ground stations to spacecraft; (e) communication with astronauts; (f) transfer of information between the various ground facilities and control centers; (g) processing of data acquired from the launch vehicles and spacecraft; and (h) reception of television transmission from space vehicles. Such support is essential for achieving the scientific objectives of all flight missions, for executing the critical decisions which must be made to assure the success of these flight missions, and, in the case of Shuttle missions, to insure the safety of the crew.

Tracking and acquisition of data for the spaceflight projects is accomplished through the use of a worldwide network of NASA ground stations, and by the first of a system of three tracking and data relay satellites in geosynchronous orbit working with a single highly specialized ground station. Ground facilities are interconnected by ground communications lines, undersea cables, and communications satellite circuits which are leased from communications carriers, both domestic and foreign. This interconnection provides the communications capability needed between spacecraft and the control centers from which the flights are directed.

To meet the support requirements levied by the wide variety and large number of flight projects, NASA has established three basic support capabilities to meet the needs of all classes of NASA flight missions. These are the spaceflight tracking and data network (STDN), which supports Earth orbital missions; the deep space network (DSN), which supports planetary and interplanetary flight missions; and the tracking and data relay satellite system (TDRSS), which will provide all low Earth orbital mission support when it becomes fully operational. The STDN will remain the primary Earth orbital support network until three TDRSS spacecraft are launched, properly positioned, and have completed preoperational testing to ensure reliable mission operations support.

When the TDRSS is fully operational, a phaseout of selected STDN ground stations will be initiated. This is presently planned for 1985. Certain facilities of the STDN will be retained to provide support to geosynchronous and highly elliptical missions which cannot be supported via the TDRSS or to provide launch and Shuttle landing support. These remaining facilities, except for the launch and Shuttle landing support facilities, are to be consolidated with the DSN stations under the management of the Jet Propulsion Laboratory (JPL). The consolidation, when completed, will provide a single network to support geosynchronous, highly elliptical, and planetary missions. The consolidated network will also support those spacecraft, now in low-Earth orbit, which are not compatible with TDRSS.

The Space Network consists of TDRSS and a number of NASA ground elements to provide the necessary tracking, telemetry, command, and communication services to low-Earth orbital spacecraft. The TDRSS itself will consist of a three-satellite ground terminal located at White Sands, N. Mex. The satellites communicate with the user spacecraft in space and relay information to and from the ground terminal. From the ground terminal, satellite and ground communication links interconnect the NASA elements of the network and any remotely located user facilities.

The fiscal year 1985 request includes funding for: Repayment of the loans extended by the Federal Financing Bank (FFB) for TDRSS development; operations payments to the TDRSS contractor; manpower and services necessary to operate and maintain the NASA elements of the network; and system engineering, engineering analyses and other support services to the network elements such as mission planning, logistics, and documentation.

The TDRS-1 was launched in April 1983, and the inertial upper stage (IUS) booster failed to deliver the TDRS spacecraft into the correct orbit. In late June, the mission was recovered through a complex sequence of maneuvers, and the spacecraft was placed into its nominal orbit. Since that time, the spacecraft has supported subsequent Shuttle missions, including Spacelab-1, while continuing the test and checkout of the TDRSS spacecraft and ground terminal. Recently, the spacecraft has experienced failures of the Ku band forward link that provides communication from TDRSS to the user spacecraft. The cause of these failures is currently under review.

The launches of TDRS-B and -C have been delayed while modifications are being made to the IUS to rectify the causes of the anomaly experienced during the first launch. Current plans anticipate launch of the second TDRS in early 1985 with the third launch following in mid-1985. These launches will complete the operational constellation of three TDRS's. Production of TDRSS spacecraft continues with TDRS-B having completed testing and been placed in storage. TDRS-C has completed environmental tests and is being prepared for storage (some modifications to these spacecraft may be necessary as a result of the TDRS-1 problem). TDRS-D, first of the ground spares, begins environmental testing this spring. The TDRS B-F will have the C-band modification for Government communication use. Principal agencies that plan to use C-band are DOD, NASA and the U.S. Information Agency (USIA).

The ground network includes STDN, consisting of 15 geographically dispersed ground stations which support Earth orbital mission; DSN, consisting of three stations approximately 120 degrees apart in longitude for continuous mission viewing, which support planetary and interplanetary flight missions; and support for aeronautics balloon and sounding rocket (AB&SR) programs at the Wallops Flight Facility (WFF), the Dryden Flight Research Facility (DFRF), the Moffett Field Flight Complex (MFFC), and White Sands Missile Range, as well as instrumentation support at the National Balloon Facility at Palestine, Tex.

Funds requested for the communications and data systems program provide for the implementation and operation of facilities and systems which are required for data transmission, mission control and data processing support.

Communication circuits and services are necessary to transmit data between the remote tracking and data acquisition facilities, launch areas, and the mission control centers. Real-time information is crucial to determining the condition of the spacecraft and payload control. Data received from the various spacecraft must be processed into a usable form before transfer to control centers and experimenters. Such support is mandatory for achieving mission objectives. Missions supported include Shuttle, NASA scientific and applications missions and international cooperative efforts.

Committee comments

The Committee regrets that the launches of TDRS-B and -C have again been delayed due to the difficulties encountered with the IUS. However, even with the single TDRS operating in orbit, NASA has been able to provide essential and critical support to its end users, although with some compromise. The Committee recognizes that NASA will have to extend its ground station activities an additional 6 months as a result of these delays, as well as continue funding the White Sands Test Facility, pending the launches of TDRS-B and -C in 1985. The Committee expects to be kept well informed as to developments concerning the IUS and the eventual launch of TDRS-B and -C. TDRSs is an essential component of our space communications network and should be made operational at the earliest possible date.

The Committee awaits final resolution of the two separate K-band problems affecting TDRS-A and expects to be informed as soon as these problems have been resolved.

The Committee supports the fiscal year 1985 request of $795,700,000 for space and ground networks, communications, and data systems.

CONSTRUCTION OF FACILITIES—$150,000,000

The Committee authorizes $150 million for construction of facilities, $10 million below the administration request. This authorization is for the following purposes:

(1) Repairs to test stand 500, George C. Marshall Space Flight Center, $1,600,000;

(2) Space Shuttle facilities at various locations as follows:

(A) Modifications of Site electrical substation Lyndon B. Johnson Space Center, $3,200,000;

(B) Modification for single engine testing, National Space Technology Laboratories, $3 million;

(C) Construction of launch complex 39 logistics facility, John F. Kennedy Space Center, $10 million;

(D) Construction of solid rocket booster assembly and refurbishment facility, John F. Kennedy Space Center, $15 million;

(3) Space Shuttle payload facilities at various locations as follows:

(A) Construction of additions to cargo hazardous servicing facility, John F. Kennedy Space Center, $4,600,000;

(B) Construction of biomedical research facility, Ames Research Center, $2,100,000;

(4) Construction of addition to network control center, Goddard Space Flight Center, $2,200,000;

(5) Construction of Earth and space science laboratory, Jet Propulsion Laboratory, $12,200,000;

(6) Construction of numerical aerodynamic simulation facility, Ames Research Center, $11,500,000;

(7) Modifications of the 8-foot high temperature tunnel, Langley Research Center, $13,800,000;

(8) Construction of 34-meter antenna, Madrid, Spain, $6 million;

(9) Modifications of 64-meter antenna, DSS–63, Madrid, Spain, $7,800,000;

(10) Repair of facilities at various locations, not in excess of $750,000 per project, $20 million;

(11) Rehabilitation and modification of facilities at various locations, not in excess of $750,000 per project, $25 milllion;

(12) Minor construction of new facilities and additions to existing facilities at various locations, not in excess of $500,000 per project, $5 million; and

(13) Facility planning and design not otherwise provided for $12 million.

The construction of facilities (CoF) appropriation provides for contractual services for repair, rehabilitation and modification of existing facilities; the construction of new facilities; the acquisition of related facility equipment; and the design of facilities projects and advance planning related to future facilities needs.

The funds requested for 1985 provide for: the continuation of prior year's endeavors in meeting the facilities requirements for the Space Shuttle; Space Shuttle payload support operations; modification of aeronautical research and development facilities; repair, rehabilitation, and modification of other facilities to maintain, upgrade and improve the usefullness of the NASA physical plant; minor construction of new facilities; and facility planning and design activities.

The projects and amounts in the budget estimate reflect Space Shuttle and Space Shuttle payload requirements that are time sensitive to meet specific milestones. Other program requirements for 1985 include the repairs to test stand 500 at Marshall Space Flight Center; construction of a numerical aerodynamic simulation facility at the Ames Research Center; modifications to the 8-foot high temperature tunnel at Langley Research Center; construction of an addition to the network control center at Goddard Space Flight Center, construction of an Earth and space science laboratory at the Jet Propulsion Laboratory; and construction of a 34-meter antenna, and modifications of a 64-meter antenna, DSS–63, in Spain.

The fiscal year 1985 program continues to meet the objectives of preserving and enhancing the capabilities and usefulness of existing facilities and to ensure safe, economical and efficient use of the NASA physical plant. This request continues the necessary rehabilitation and modification program as in prior years and continues a repair program. The purpose of the repair program is to restore facilities to a condition substantially equivalent to their originally designed capability. The minor construction program continues to provide a means to accomplish smaller facility projects which accomodate changes in technical and institutional requirements.

Committee comments

The Committee recommends an authorization of $150 million for construction of facilities, $10 million less than the administration's request. To partially achieve this reduction, NASA is requested to defer $5 million from the administration's request for construction of the numerical aerodynamic simulation (NAS) facility at Ames Research Center. Because there have been delays in the procurement of some of the computer equipment associated with the NAS, the Committee feels that the resulting fiscal year 1985 authorization of $11,500,000 will not seriously impat the implementation of the NAS system. Also, the Committee recommends a $5 million general reduction of less critical construction of facilities activities, at the discretion of the agency.

RESEARCH AND PROGRAM MANAGEMENT—$1,331,000,000

The Committee authorizes $1,331,000,000 for research and program management, as requested.

Summary of budget plan by function

Personnel and related costs	$935,928,000
Travel	28,000,000
Operation of Installation	367,072,000
Facilities services	(198,679,000)
Technical services	(57,765,000)
Management and operations	(110,628,000)
Total	1,331,000,000

The research and program management appropriation funds the performance and management of research, technology and test activities at NASA installations, and the planning, management and support of contractor research and development tasks necessary to meet the Nation's objectives in aeronautical and space research. Objectives of the efforts funded by the research and program management appropriation are to (1) provide the technical and management capability of the civil service staff needed to conduct the full range of programs for which NASA is responsible, (2) maintain facilities and laboratories in a state of operational capability and manage their use in support of research and development programs, and (3) provide effective and efficient technical and administrative support for the research and development programs.

The 22,000 permanent and temporary civil service personnel at 8 instllations and Headquarters are funded by the research and program management appropriation. This civil service workforce is NASA's most important resource and is vital to future space and aeronautics research activities. Seventy percent of the research and program management appropriation is needed to provide for salaries and related costs of the civil service workforce. About 2 percent is for travel, which is vital to successfully manage the agency's in-house and contracted programs. The remaining amount of the research and program management appropriation provides for the research, test and operational facility support, and for related goods and services necessary to successfully operate the NASA installations and to efficiently and effectively accomplish NASA's approved missions.

Committee Comment

The Committee authorized the administration's request of $1,331,000,000 for research and program management for fiscal year 1985. However, within these funds authorized, the Committee recommends that no more than $1 million be made available to fund the activities of the National Commission on Space, as authorized under title II of this bill.

NATIONAL COMMISSION ON SPACE

Committee comments

Due to the changing nature of the space environment, it is necessary for the United States to publicly reassess its space programs and space policies in order to insure the U.S. leadership position, to maximize the national benefits, to promote the peaceful exploration and utilization of space, and to guarantee that the U.S. space program continues in a coherent manner.

Much has happened since the United States first mobilized efforts in space in 1958 in response to the Soviet challenge. No longer is the only competition in space the Soviet Union, and no longer is NASA the only U.S. Government agency involved in civil space programs and space policies. Today, we face increased competition in space, particularly for commercial purposes, from the Europeans and Japanese, and we rely increasingly on space for vital private and public functions (communications and military reconnaissance) and for useful purposes (land remote sensing, navigation, and weather forecasting). The dawn of the era of space commercialization has arrived; the time has come for the United States to reaffirm its commitment to the space program and to reassess the role of the private sector and the implications of international competition if it is to safeguard its leadership position in space.

In order to maximize the economic, scientific and natural security benefits that can accrue from a space program, the Committee instructs the President to establish a National Commission of Space. The Commission shall consist of 15 members appointed by the President. The members shall be selected from among individuals from State and local governments, industry, business, labor, academia and the general population, who by reason of their background, education, training or experience, possess experience in scientific and technological pursuits, as well as the use and implications of the use of such pursuits. The Commission shall have 12 months to make a comprehensive investigation of existing and proposed space activities in the United States in order to assess their adequacy in meeting the present and future needs of the Nation. At the end of this period, the Commission shall submit the results of this study, together with recommendations for such legislation as the Commission deems appropriate. To carry out the activities of the Commission, the Committee provides $1 million from within available funds in the research and program management account.

The Committee believes that both NASA and the U.S. space program are at the threshold of a new era. The time has come to reassess the basic institutions and policy principles for civilian space activities that were established in the National Aeronautics and Space (NAS) Act of 1958 and to reaffirm the Nation's commitment to preeminence in space; the time has come to investigate existing and proposed space activities and to review the known and possible economic, social, environmental, foreign policy and national security needs.

To insure this process, the Committee instructs the National Commission on Space to consider a broad array of issues, including:

The adequacy of the National Aeronautics and Space Act of 1958 to serve as a basis for future national space policy;

Alternative roles and relationships of the civil and national security space programs;

Alternative roles and relationships of the private and public sectors in national space efforts;

The suitability of existing Federal organizational arrangements to carry out future governmental responsibilities in space research, technology development, and applications;

The opportunities for, and barriers to, private sector utilization of the space environment and participation in national space programs; and

Considerations involving international cooperation and competition in the utilization of the space environment.

NASA, since its establishment in 1958, has had phenomenal success in its programs of research, technology development, and space utilization for the benefit of all mankind. The world has shared in the success of the Moon landings, the spectacular images of Jupiter and Saturn, and of course, the Space Shuttle. Our country's newest space initiative, which this Committee fully endorses, is the administration's proposal to develop within a decade a permanently manned space station. Less spectacular but extremely beneficial to mankind are many other NASA research projects.

However, in spite of these advances, there is still no *overall* agreement about the direction or scope the civilian space program should assume in the future. As noted in a 1982 Office of Technology Assessment Report, "Civilian Space Policy and Applications:"

> The lack of consensus is of concern because many desirable space activities require continued Federal support. The Government continues to play a crucial role in at least four areas that are essential to the Nation's future in space but have little potential for immediate commercial return: contribution to advanced R&D, continuation of space science, provision of public goods and services, and regulation/coordination of national efforts, particularly with respect to international agreements.
>
> The failure to agree about the aims of the U.S. space program has occurred as other nations have been expanding their own programs. When the U.S. space program began, the Soviet Union was our only competitor in space. The Soviets have never challenged our leadership in space applications. Now, however, international competition in space applications is a reality. The Europeans and the Japanese have targeted specific space technologies for development, and they will soon be providing stiff competition for services theretofore offered only by the United States. Their increased activities threaten the loss of significant revenue opportunities for the United States as well as a potential loss of prestige and influence. Japanese and Eu-

> ropean technologies now capture a small but growing portion of the world market in satellite communications technology. Their position is likely to strengthen in time. In the near future they are also likely to be in a similar position with respect to launch services and remote sensing systems.
>
> Unless the United States is prepared to commit more of its public and private resources to space than it now does, it will lose its preeminence in space applications during the 1980s. Both technological and commercial leadership are at stake. The U.S. leadership position will depend not only or even primarily on spending more money, but on effectively allocating our technical, financial, and institutional resources to meet international competition. Given the likely constraints on the Federal budget, it will be important to decide in what areas the United States wishes to compete, because attempts to maintain a comprehensive program without additional capital and manpower may lead to second-best technology and systems and/or inadequate institutional support.

To assist in the creation of the consensus so vital for long-term space programs and policies, the Committee feels that it is most apporpriate for a National Commission on Space to be created. The Committee notes that in 1966 a similar situation occurred in the area of ocean development. The oceans had been viewed largely as a scientific curiosity and a means for transportation. The potential for marine resource development was really just getting under way. There also were a number of policy issues related to the utilization of the oceans. In response to this situation, the Committee recommended that Congress establish a Marine Resources Commission to be headed by Julius Stratton. The Stratton Commission had an excellent and diverse membership that was supported by a strong professional staff. They reviewed the diverse Federal oceans programs and the Government's ability to respond to various opportunities, and the Commission's report provided an extremely valuable guide in the oceans area.

The Committee feels that the National Commission on Space will provide a long-term guide of comparable value to the civilian space policy area.

The Committee realizes that a Senior Interagency Group (SIG) on Space has been created within the administration to decide space policy issues. However, the SIG, which is an arm of the National Security Council, is a questionable mechanism for handling civilian space policy issues. Space policy needs more public discourse and public consensus. Under the SIG arrangement, it is not possible to formulate such a public civilian space policy and to generate the necessary broad-based public support.

The Committee recalls that in 1969 an interagency Space Task Group, comparable to today's SIG, was established to assess the post-Apollo era space program. That Space Task Group's final report, "The Post-Apollo Space Program: Directions for the Future," went nowhere, despite its laudable goals and objectives, because it failed to provide a forum for public discourse or to establish a public consensus. Today's SIG faces a similar fate. Both of these interagency task forces lack the potential to increase the public's understanding of the values derived from space activity or the public's understanding and acceptance of long-term goals and objectives which establish the framework for the space program.

The Committee feels that this understanding and the public support required for a long-term commitment to space can best be fostered through the establishment of a National Commission on Space. To quote from the above-mentioned OTA report on civilian space policy:

> A pervasive element is the lack of consistent long-term goals and clear policy initiatives, from either the executive or the legislative branches of the Government. This situation derives in part from the fact that since the Apollo decision was made in 1961, the number of major actors in civilian space activities has increased from one agency (NASA) to include six Federal agencies and numerous private firms. Not surprisingly, the many groups with direct and indirect interests in space agree neither about the overall importance of the civilian space program nor about specific applications projects. In the absence of broad consensus and a means for deciding between opposing views, the scope of individual projects is determined by the annual budget deliberations among the executive agencies, the Office of Management and Budget (OMB), and Congress. Over time, the sum of these decisions determines the overall course of the space program. However, the annual budget cycle bears little relationship to the long-term evolutionary cycle of space systems. In addition, OMB has not chosen to view investment in space activities from a long-range perspective. Until such time as a broad consensus is formed, it is left to the President or Congress to set forth a coherent, strategic framework for civilian space policy. In the absence of such direction, the current drift will continue and worsen. . .
>
> In order to plan for the future of the space program in the context of other national needs, the United States needs a multi-representative forum to discuss and recommend comprehensive, long-term goals. Such a forum could coordinate the interests of all the major actors in order to allow equitable and stable decisions to be made about the overall direction of the civilian space program. Though such a body would not itself direct the course of the space program, because this responsibility lies with the President and Congress, it could focus the debate and provide timely advice. . .
>
> A device that is occasionally employed to investigate a broad area of national interest is a Presidential or National (implying congressional and private involvement) commission, board, committee, or council. . .
>
> One possibility for space is to charter for a specified term, a "National Space Commission" with membership from the general public, State and local governments, in-

> dustry (particularly aerospace and electronics firms), academia, Congress, and the executive branch—NASA, State, DOD, Interior, Commerce, and Agriculture. The Commission would be charged with reviewing and assessing the civilian space program and its benefits, and recommending long- and short-term objectives, and a time frame for their achievement. The product of the Commission would be a major report, recommending short- and long-term goals for the U.S. space program. The Commission would be publicly supported; following its report, congressional hearings could be held on its recommendations, and legislation prepared for consideration by Congress.
>
> Such a forum enables participation from a broad set of interests in developing program goals, it operates in a manner that is outside normal channels and hence would be less threatening to the annual budget preparation process; it would be public and could solicit public input as appropriate; and it would serve as an expression of broad national and bipartisan support for the civilian space program. In order to provide a specific objective for such a group, a major report should probably be specified, with annual updates for the life of the Commission.
>
> A National Space Commission, because of its public, short-term nature, could not substitute for a means within the administratioin to resolve issues, develop policy proposals, review goals, and set strategy for the space program. The Commission therefore is complementary to the previous two options, although it would deal with many of the issues. The Commission would have the advantage of being able to evaluate public response and support, and to focus that support on specific goals. It also provides a device for full discussion of congressional, executive branch, and private sector views in a constructive setting.

The Committee agrees with OTA's analysis and supports the establishment of a National Commission on Space. The Committee believes that such a Commission will reinforce our resolve to utilize the space environment for the maximum national benefit, will make recommendations on a number of issues and programs that will shape the future of the space program, will provide the public support and commitment required to maintain U.S. preeminence in space, and will help mobilize our national spirit and resolve and give direction to our space program.

The Committee instructs the President to create a National Commission on Space within 90 days of the date of enactment of this legislation. The Committee looks forward to working with the President and the Commission in formulating long-term space policy options and goals and in responding to the challenges and opportunities of space.

ESTIMATED COSTS

In accordance with paragraph 11(a) of rule XXVI of the Standing Rules of the Senate and section 403 of the Congressional Budget

Act of 1974, the Committee provides the following cost estimate, prepared by the Congressional Budget Office:

U.S. CONGRESS,
CONGRESSIONAL BUDGET OFFICE,
Washington, D.C., May 10, 1984.

Hon. BOB PACKWOOD,
Chairman, Committee on Commerce, Science, and Transportation,
U.S. Senate, Dirksen Senate Office Building, Washington, D.C.

DEAR MR. CHAIRMAN: The Congressional Budget Office has prepared the attached cost estimate for H.R. 5154, the National Aeronautics and Space Administration Act of 1985.

If you wish further details on this estimate, we will be pleased to provide them.

Sincerely,

RUDOLPH G. PENNER.

CONGRESSIONAL BUDGET OFFICE COST ESTIMATE

1. Bill number: H.R. 5154.

2. Bill title: The National Aeronautics and Space Administration Act of 1985.

3. Bill status: As ordered reported by the Senate Committee on Commerce, Science and Transportation, May 8, 1984.

4. Bill purpose: The bill authorizes the appropriation of $7,582 million for the National Aeronautics and Space Administration (NASA) for fiscal year 1985 and establishes a National Commission on Space. The authorization includes $2,790 million for the production and operation of the space shuttle, $150 million for development of a space station, $2,366 million for other research and development activities, and $796 million for the space tracking system. The bill also includes $150 million for construction of facilities and $1,331 million for research and program management. Also authorized are such sums as may be necessary for increases in employee benefits as authorized by law. The amounts authorized are $91 million above the President's 1985 budget request for NASA and approximately $385 million above the 1984 appropriations for NASA.

As established in this bill, the National Commission on Space would formulate a long-range plan for the civilian space program and submit the paln to the President and the Congress within twelve months. The commission would be composed of 15 members appointed by the President and representatives of various government agencies. Of the amounts authorized in this bill for NASA research and program management, $1 million is to be used for the activities of the commission. The authorization for the commission ends 60 days after the report is submitted.

5. Estimated cost to the Federal Government:

[by fiscal years, in millions of dollars]

	1985	1986	1987	1988	1989
Estimated authorization levels:					
Function 250—Civilian space	6,885				

	1985	1986	1987	1988	1989
Funcition 400—Aeronautics	697				
Function 920—Pay raises	33				
Total	7,615				
Estimated outlays:					
Function 250—Civilian space	5,101	1,505	261	17	1
Funcition 400—Aeronautics	453	189	48	4	3
Function 920—Pay raises	31	2			
Total	5,585	1,696	309	21	4

Basis of estimate: The authorization levels are the amounts specified in the bill, plus an estimated $33 million for pay increses in fiscal year 1985 as authorized by the bill. The estimate of outlays assumes that all funds authorized will be appropiated prior to the beginning of fiscal year 1985 and that spending will reflect historical patterns.

6. Estimated cost to State and local governments: None.

7. Estimate comparison: None.

8. Previous CBO estimate: On March 21, 1984, the Congressional Budget Office prepared a cost estimate on H.R. 5154, the National Aeronautics and Space Administration Act of 1985, as ordered reported by the House Committee on Science and Technology. The House bill authorized the appropriation of $7,531 million in 1985 for NASA and a National Commission on Space, $51 million less than the amount authorized in the Senate Commerce Committee version.

9. Estimate prepared by: Jeff Nitta.

10. Estimate approved by: James L. Blum, Assistant Director for Budget Analysis.

REGULATORY IMPACT STATEMENT

In accordance with paragraph 11(b) of rule XXVI of the Standing Rules of the Senate, the Committee provides the following evaluation of the regulatory impact of the legislation:

This bill authorizes the appropriation of funds for the conduct of space and aeronautical research and development activities to carry out the policy and purpose of the National Aeronautics and Space Act of 1958. These activities are conducted in NASA laboratories by NASA personnel and through contracts with industry, universities and research institutions for research and development and for supporting scientific and technical services. The Committee has concluded the nature of these activities is such that there is no regulatory impact on individuals and businesses and no effect on individual privacy.

In accordance with the establishment of the National Commission on Space, as called for in title II of this bill, the Committee expects that there will be an additional paperwork impact as the Commission performs its study and analysis. However, the Committee believes that this impact will not be burdensome. When the Commission delivers its report to the President and Congress, approximately 1 year after the establishment of the Commission, the

Commission will expire. At this time, the Committee will be able to reassess the paperwork impact of the Commission.

Section-by-Section Analysis

Section 1.—The first section states the short title of the legislation, the "National Aeronautics and Space Administration Act, 1985".

TITLE I

Sec. 101.—An authorization of $7,582.4 million is provided as follows:

(a) $2,516.1 million for "Research and Development";
(b) $3,585.3 million for "Space Flight, Control, and Data Communications";
(c) $150.0 million for "Construction of Facilities"; and
(d) $1,331.0 million for "Research and Program Management".

Sec. 102.—Authorization is provided for an increase in the "Construction of Facilities" funds of up to 10 percent, at the discretion of the NASA Administrator, or 25 percent, following a report to the Senate and House authorization Committees justifying the increase.

Sec. 103.—Up to ½ of 1 percent of the funds appropriated for "Research and Development" and "Space Flight, Control, and Data Communications" may be transferred to "Construction of Facilities". This amount then may be added to $10 million of the "Construction of Facilities" appropriations for additional construction of facilities and land acquisition, if the NASA Administrator justifies the expenditure.

Sec. 104.—No appropriations may be used for any program deleted by Congress and no appropriations may exceed the amount authorized for that particular program. For NASA to obtain funding for programs not presented to the Senate and House in the routine manner, NASA must first prepare a report justifying the proposal. Then, 30 days must elapse after receipt by the Senate and the House of this report.

Sec. 105.—Consideration shall be given to geographical distribution of Federal research funds whenever feasible.

Sec. 106.—Funding is provided to augment the structural spares for the current four-orbiter Space Shuttle fleet and to maintain production readiness for the development of a fifth orbiter.

Sec. 107.—The civil space station may not be used to carry or to deploy in space nuclear weapons or any other weapons of mass destruction and may be used only for peaceful purposes.

Sec. 108.—NASA should, as expeditiously as possible, finalize and enter into a contract to develop the Advanced Communications Technology Satellite, which is funded under research and development in section 101 of this title. Furthermore, NASA should enter into this contract only with the firm with which it was previously negotiating.

Sec. 109.—This section amends the National Aeronautics and Space Act of 1958 to require NASA to fully support space commercialization and to encourage NASA's expanded activity in the Earth Sciences.

Sec. 110.—This section approves NASA's request to allow the NASA Administrator to transfer title to personal property loaned by NASA to academic institutions or nonprofit organizations, once NASA ascertains that it no longer needs the property.

TITLE II

Sec. 201.—This title may be cited as the "National Commission on Space Act".

Sec. 202.—The purpose of the National Commission on Space (Commission) is to assist the United States in maintaining its preeminence in space and to develop policy and program options for our Nation's civil space program.

Sec. 203.—Congress has found and declared that the U.S. space program has provided social, economic, and national security benefits to our Nation. Furthermore, as we enter a new era of international competition and cooperation in space, and as the private sector evolves as a major participant in the space environment, our Nation's interest would be best served by a public forum to identify policy and program options for our civilian space program.

Sec. 204. This section outlines the framework and membership for the Commission, the most significant aspects of which are:

1. The President shall appoint 15 qualified representatives from business, academia, and State and local governments to serve on the Commission. One of these members shall serve as Chairman of the Commission and one shall serve as Vice Chairman;
2. The President shall appoint four individuals who are employees of the Federal Government to serve as ex officio members of the Commission;
3. The President shall appoint two U.S. Senators and two U.S. Representatives to serve as advisory members of the Commission; and
4. The Commission shall cease to exist 60 days after it has submitted the report required in section 205.

Sec. 205.—The Commission shall review our Nation's public and private capabilities in space science, technology, and applications and assess how our Nation's interests can be best served by these and additional capabilities. Furthermore, the Commission will identify, among other things, alternative roles and relationships of the civilian and national security space programs; the opportunities for and barriers to private sector utilization of space; and international competition and cooperation in space.

Within 12 months after the establishment of the Commission, the Commission shall submit to the President and to the Senate Committee on Commerce, Science, and Transportation and the House Committee on Science and Technology the results of this study along with appropriate recommendations.

CHANGES IN EXISTING LAW

In compliance with paragraph 12 of rule XXVI of the Standing Rules of the Senate, changes in existing law made by the bill, as reported, are shown as follows (existing law proposed to be omitted is enclosed in black brackets, new material is printed in italic, existing law in which no change is proposed is shown in roman):

THE NATIONAL AERONAUTICS AND SPACE ACT OF 1958

Section 102 of that Act

SEC. 102. (a)-(b) * * *

(c) The Congress declares that the general welfare of the United States requires that the National Aeronautics and Space Administration seek and encourage, to the maximum extent possible, the fullest commercial use of space.

[(c)**]** *(d)* The aeronautical and space acitivities of the United States shall be conducted so as to contribute materially to one or more of the following objectives:

(1) The expansion of human knowledge *of the Earth and* of phenomena in the atmosphere and space;

(2) The improvement of the usefulness, performance, speed, safety, and efficiency of aeronautical and space vehicles;

(3) The development and operation of vehicles capable of carrying instruments, equipment, supplies, and living organisms through space;

(4) The establishment of long-range studies of the potential benefits to be gained from, the opportunities for, and the problems involved in the utilization of aeronautical and space activities for peaceful and scientific purposes;

(5) The preservation of the role of the United States as a leader in aeronautical and space science and technology and in the application thereof to the conduct of peaceful activities within and outside the atmosphere;

(6) The making available to agencies directly concerned with national defense of discoveries that have military value or significance, and the furnishing by such agencies, to the civilian agency established to direct and control nonmilitary aeronautical and space activities, of information as to discoveries which have value or significance to that agency;

(7) Cooperation by the United States with other nations and groups of nations in work done pursuant to this Act and in the peaceful application of the results thereof; and

(8) The most effective utilization of the scientific and engineering resources of the United States, with close cooperation among all interested agencies of the United States in order to avoid unnecessary duplication of effort, facilities, and equipment.

[(d)**]** *(e)* The Congress declares that the general welfare of the United States requires that the unique competence in scientific and engineering systems of the National Aeronautics and Space Administration also be directed toward ground propulsion systems research and development. Such development shall be conducted so as to contribute to the objectives of developing energy- and petroleum-conserving ground propulsion systems, and of minimizing the environmental degradation caused by such systems.

[(e)] *(f)* The Congress declares that the general welfare of the United States requires that the unique competence in scientific and engineering systems of the National Aeronautics and Space Administration also be directed toward the development of advanced automobile propulsion systems. Such development shall be conducted so as to contribute to the achievement of the purposes set forth in section 302(b) of the Automotive Propulsion Research and Development Act of 1978.

[(f)] *(g)* The Congress declares that the general welfare of the United States requires that the unique competence of the National Aeronautics and Space Administration in science and engineering systems be directed to assisting in bioengineering research, development, and demonstration programs designed to alleviate and minimize the effects of disability.

[(g)] *(h)* It is the purpose of this Act to carry out and effectuate the policies declared in subsections (a), (b), (c), (d), [(e), and (f)] *(e), (f), and (g).*

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